How do teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum? A case study of two primary schools in Hong Kong

Abstract

In 2000, the Curriculum Development Council (CDC) of Hong Kong launched curriculum reform for all school subjects to equip students with generic skills perceived essential for the 21st Century. As part of this, the new Primary General Studies (PGS) programme implemented in 2004, adopted an inquiry-based learning approach. The literature shows that inquiry-based learning not only has origins linked to science inquiry and Dewey's theory of inquiry, but also intersects with theories of constructivism. Similar to constructivism inquiry-based learning also incurs the controversies for its theoretical foundation. Moreover, the precedents of enacting inquiry-based learning in classrooms have alerted teachers to its practice-based challenges.

Furthermore, teachers' beliefs have been recognized as a major factor influencing teachers' actions especially in the implementation of a new teaching method. Therefore, three years after its launch, a study was proposed to investigate the impacts of teachers' beliefs on the implementation of inquiry-based learning in the new PGS curriculum. The research was in the form of qualitative case studies of two schools. Eight teachers were involved, while four of them were studied in more detail. The results show that different teachers held diverse beliefs about inquiry-based learning. Such variation in teachers' beliefs was found to impact on teachers' implementation of inquiry-based learning. Finally, recommendations about the importance of teachers' reflection, arrangement of resources, preparation for teachers and students and in-services training, are made to teachers, school administration, and local authority.

In this study, the "hypothetical components of belief" suggested by Sigel (1985) were adopted as the major theoretical framework and within such a framework contextual factors of individual school were found to have played crucial roles both in influencing teachers' beliefs and teachers' actions.

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How do teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum? A case study of two primary schools in Hong Kong

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Contents

List of Illustrations

Lists of Tables

Chapter 1

Introduction

1.1 Background of the study

Since 2001 the Curriculum Development Council (CDC) of Hong Kong launched the curriculum reform by issuing the "*Learning to Learn*" (CDC, 2001) document, the CDC has been revising the curricula of all school subjects to fulfil the spirit and direction of the new movement. Such a curriculum reform has generated a series of academic and political issues. One of the major aspects that concern teachers most is the alteration of their daily practice in classrooms (Lee, 2000; Lee and Gerber, 1996, Lee and Dimmock, 1998).

The new Primary General Studies (PGS) curriculum is a landmark of the curriculum reform in Hong Kong because it was the first primary school subject being revised according to the inquiry approach. It is also the subject nature of the PGS that allows it to be reconstructed with most flexibility (CDC, 1994). Almost all principles, objectives and aims mentioned in the general blueprint of the curriculum reform could be found in the new PGS curriculum. One of the most prominent changes in this curriculum is the adoption of the inquiry-based approach in both teaching and learning. Unlike other changes, this new direction of teaching and learning directly affects the daily practice of teachers' teaching (Van Deur & Murray-Harvey, 2005; Chan 2001; Rankin 2000). Logically speaking, while teacher is deemed as the most important factor in curriculum reform (Woolfolk, Rosoff, & Hoy

1991; Stein & Wang, 1988; Ashton, 1984; Ashton et. al., 1983; Centra and Potter, 1980; Guskey, 1986; Joyce & Weil, 1972), the success of such a dramatic change in teaching and learning approaches must earn the support from PGS teachers. However, the researcher[1] has observed a variation in teachers' beliefs in inquiry-based learning and thus distinctive practices in implementing the new PGS subject in difference schools. Hence, a study was proposed to investigate how teachers' beliefs in inquiry-based learning affect the implementation of inquiry-based learning in the new PGS curriculum. It was expected that the study should yield fruitful findings that may provide reference for teachers, school administrators and the local authority.

1.2 Research context

According to Dewey (1938b), learning experience is comprised of two elements, one active and the other passive. In the active sense, experience means to try and to do experiment. Dewey's interpretation on the relationship between education and experience has led to various developments in education and curriculum research. One of these developments is clearly inquiry-based learning while another important direction is the constructivist theories of knowledge, especially, when Dewey (1938a) defined the acquisition of knowledge as a process of discovery or in other words, the familiar concept we use nowadays—inquiry (Dewey, 1938b). Since Dewey, inquiry has been playing an important role in the reform literature in defining the nature of science and the method of learning science (Anderson, 1993). From that, inquiry has also become a prevailing pedagogical approach in

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both teaching science and non-science subjects (National Research Council, 2000).

1.2.1 The argument on inquiry-based learning

In spite of the appealing rhetoric of the inquiry-based approaches, the arguments on its theoretical and practical values have never ceased. Such controversies at least include:

1. The issues in defining inquiry-based learning. That includes the proper terminology representing the concept, its relationship with science investigation and more important, the positioning of the concept as a methodology or a philosophical principles.
2. The theoretical argument about inquiry-based learning and its major theoretical foundation; constructivism.
3. Other controversies in aspects of education psychology (i.e. issue in cognitive workload and problem-solving settings of human mind), social and economical consideration (i.e. the discourse of skill learning).
4. The practical challenges arising from various precedents (e.g. Kirschner et al., 2006; Lawson, 1995; Goldsworthy and Feasey, 1994; Van Glaserfeld, 1992).

Despite these unresolved issues, inquiry-based learning and the related approaches have never lost their strengths. Inquiry approaches have been upheld in curriculum reforms worldwide (Anderson, 1998) and one of the examples is the curriculum reform in Hong Kong.

1.2.2 The inquiry nature of the curriculum reform in Hong Kong

As Dow (2000) asserted, today we may need the skills of scientific

thinking and inquiry more than ever, as we cope with the challenges of factual overload in our information age. Such an assumption is simply the rationale of the "*Learning to Learn*" curriculum reform in Hong Kong. In fact, the spirit of curriculum reform in Hong Kong has been described as a curriculum for the children and for their future life in the new millennium (CDC, 2001a). Throughout the reform documents and the policies following, there are two distinctive aims proposed by the Hong Kong Government.

- *To provide students with life-long learning experience for whole person development… so that all students could become…contributing members of society, the nation and the world.*
- *To help students to cultivate positive values, attitudes and develop generic skills to cope with the challenges of the 21st century.*

(CDC, 2001a, p.10)

Within these aims, the seeking of life-long learning and generic skills provides rationales for the government to introduce self-regulated learning strategies at schools. The skill of inquiry or in other words, the ability to acquire knowledge throughout life has thus become one of the most prominent goals of the government.

1.2.3 The PGS in Hong Kong

As the product of the curriculum reform, the subject Primary General Studies (PGS) has its own history. The subject was first introduced to Hong Kong primary education in 1996 (CDC, 1997). Since the 1990's the authority integrated the learning elements of Primary Science, Social Studies, and Health Education into a new subject called Primary General Studies (PGS) in order to alleviate the problem of fragmented knowledge (So and others,

1999). The birth of this integrated subject once presented a dramatic shock in local primary education and teacher education (So, Cheng and Tsang, 1998). An even greater shock was then introduced in 2002 (and was implemented in 2004) when the authority issued an inquiry-based curriculum: the new PGS (CDC, 2002). It had been decided by the authority that the direction of curriculum development in PGS is to move from the content-focused and teacher-centred approaches to the learner-focused and inquiry-based approach, to enhance learners' inquiry and investigative skills for the construction of knowledge. As the official document indicates, the position of the new PGS in the school curriculum is to:

> *Provide students with opportunities to integrate skills, knowledge and values……It promotes creativity through hands-on and minds-on learning experiences and problem-solving process. It emphasizes student inquiry and the development of skills for learning to learn*.
>
> (CDC, 2002, p.2)

Therefore, inquiry becomes the major feature of this new PGS curriculum.

1.2.4 The inquiry approach in PGS

Actually, the inquiry-based approach has been adopted for years in secondary education in Hong Kong, especially in science subjects. In 2002, the authority clearly indicated in the new PGS Curriculum Guide that the new PGS should be organized and taught in an inquiry direction (CDC, 2002). The official Guide indicates

> *……schools are encouraged to use the inquiry approach in the learning and teaching of GS.*

(CDC, 2002, p.78).

The PGS has thus become the first inquiry-based subject in local primary curriculum. Despite the controversies in inquiry-based learning, the education authority in Hong Kong has committed herself to this approach as she states that:

> *Inquiry-based learning is a student-centred approach which helps students to integrate generic skills, knowledge and values in the learning*
>
> (CDC, 2002, p.79)

Nevertheless, The CDC admits that there are different methods to design and deliver an inquiry curriculum. Sliberman and others (1972) also reminded educators that there are broad strategies and special tactics that help to make inquiry more productive. They further pointed out that there is no one fixed method of operation. Silberman and others insisted that inquiry strategies are flexible and the so-called "scientific method" is not a fixed sequence of operations. Hirst (1974) also raised the point that inquiry methods are not superficially similar across different academic disciplines. These opinions simply remind the various possibilities of so-called inquiry-based approach.

Furthermore, research on the PGS lessons in Hong Kong have also uncovered problems that may create obstacles or contradictions to the implementation of the inquiry approach (So, Kong. & Leung , 2005; So, Cheng , Leung & Wong .1999; So, Cheng & Tsang, 1998; Harlen and Jelly,1997). Hong Kong PGS teachers are thus expected to face great challenges in implementing this new PGS curriculum.

1.2.5 Teachers' belief as another major issue

As any movement take place in any section of the education field, the teacher is the major factor for both facilitating and resisting the change (Fullan, 1991). Furthermore, one of the major issues in adopting the inquiry approach in the new PGS is that the implementation of inquiry-based learning relies on many factors that are controlled by teachers, such as teachers' beliefs and teachers' interpretations of the new curriculum (Sarason, 1971; Saylor & Alexander, 1974; Yeung, 2000; Garet et al., 2001; Shkedi, 2006). Recent studies also found that teacher's belief is the powerful indicator for studying teachers' influence in teaching, students' learning and the implementation of curriculum (e.g. Chang, 1997; Sun, 1991; Guo, 1970). Coupled with the finding that it takes a teacher several years to manage inquiry-based lesson well (Keys &Kennedy, 1999; Hobrook & Kolodner, 2000), therefore, proposing a study on the local teachers' beliefs and their impacts on implementing inquiry-based learning after three years (2004-2007) of the launching of the new PGS, become valuable for local teachers and policy makers.

In fact, recent studies on PGS teachers have already indicated a potential problem to the success of the new PGS curriculum (Pang, 1998; So and others 1998, 1999, 2005). Studies also show that local PGS teachers' readiness and beliefs in adopting children-centre approaches are in doubt (So and others, 1998, 1999, 2005). It thus raises a missing part of the puzzle; that is the impact of teacher's belief and its interaction with other factors that would affect the implementation of a newly introduced inquiry-based approach, especially in local primary classroom context. Hence, it was expected that the study of teachers' beliefs in inquiry-based learning and how

such beliefs and other factors affect teachers' implementation of inquiry-based learning would yield fruitful result and valuable reference to relevant studies.

1.3 The significance of the study

The proposed study was expected to shed light on the following areas:

1. The curriculum development aspect: the implementation of inquiry-based approach in the new PGS curriculum as a curriculum change.
2. Teachers' development aspect; that is teachers' beliefs in inquiry-based learning and the impact of such beliefs on their actual practices in classrooms.
3. Policy aspect: the study should reveal some useful feedback to the Hong Kong authority on its effort to promote the inquiry-based learning with special focus on the new Primary General Studies subject.

As the first primary level subject adopting inquiry-based approach, PGS provides an ideal focus for studying inquiry-based learning in local context. Coupled with the arguable findings both in inquiry-based learning and teachers' beliefs, the study of these two areas was expected to bring valuable reference to local teachers, as they have to tackle more and more inquiry-based curriculum in the future.

1.4 The overview of the thesis

Chapter one of the thesis is an introduction to the research background and rationale. The following chapters illustrate the literature review on the inquiry-based learning and the teachers' beliefs. After the literature review sections, there will be an explanation of the research methodology. As

qualitative case studies, the adoption of the research paradigm and methods will be justified at relevant sections. The chapters following will be the presentation of findings and their analysis from various instruments, namely the initial interviews, the documentary analysis, the analysis of students' work and more important, the lesson observation and the follow-up interviews. The final sections will be the discussion, conclusion and recommendation of the thesis.

Chapter 2

Literature Review

2.1 The issues in defining inquiry-based learning

The first issue in defining inquiry-based learning arises directly from the proper term used to represent such a concept. To many people, the term "inquiry" will easily cause confusion with a similar title "enquiry". Both "inquire" and "enquire" are used in American and British English (Merriam Webster, 1989). Yet, the adoption of the term "inquiry" and "inquiry-based learning" in this study, instead of "enquiry" and "enquiry-based learning", is founded on following rationales:

- John Dewey's theory of inquiry as one of the major origins of inquiry-based learning (Falk & Drayton, 2001; Fullan, 1991; Kuhlthau, 2001)
- The relationship between inquiry-based learning and science inquiry
- Inquiry is the official term used in the Primary General Studies (PGS) Curriculum Guide.

The second area that needed to be clarified is the connection between inquiry-based learning and science inquiry. For those who try to review the literature for inquiry-based learning, they will surely come upon the phenomenon that most of the studies on this topic are connected with science education. Furthermore, it is also very common for some theorists and educationalists to use the term "inquiry" or "inquiry-based learning"

interchangeably with “science inquiry”. It is because, since Dewey, inquiry has become a word with a long-standing place of honour in science education circles (National Research Council, 1996). Anderson (1998) commented that it has become the label for many new approaches to teaching promoted in curriculum movement since the 1950s and 60s. It has a special place in the current National Science Education Standards (NSES) in the USA. Anderson further pointed out that a close look at the National Science Education Standards (USA) showed that inquiry is now used in at least three different senses:

- scientific inquiry,
- inquiry learning, and
- inquiry teaching.

He reminds that scientific inquiry refers to the means scientists use to study nature and formulate explanations of what they observe. It deals with how science proceeds and can be considered independently of educational processes. Inquiry-based learning, on the other hand, usually refers to the active processes in which students are engaged as they pursue knowledge in all areas not only science. Since inquiry is the centre of science learning, therefore people easily associate inquiry-based learning with science learning only. The National Research Council U.S. (1996) even equated the concept of inquiry to science inquiry when they state:

> *Inquiry is also a pedagogical approach that helps students achieve science understanding by combining scientific knowledge with reasoning and thinking skills.* (p. 2).

In fact, such a belief could probably be developed from the scientific inquiry method mentioned in Dewey's work (Dewey, 1938b).

Dewey (1938b) defined the acquisition of knowledge as a process of discovery. In Dewey's works of latter years (especially in the book *Logic: the theory of inquiry*) he articulated such discovery as the familiar concept we use nowadays—inquiry. According to Dewey (1938b), learning experience is comprised of two elements, one active and the other passive. In the active sense, experience means to try and to do an experiment, just like the way scientists investigate science. On the other hand, Dewey also analyzed another kind of inquiry, *"common sense inquires"* in his words. He distinguished such kind of inquiry from that of the science inquiry in the way that it *"occurs for the sake of settlement of some issue of use and enjoyment, and not, as in scientific inquiry, for its own sake"* (p.60, Dewey 1938b). Yet these two types of inquiry are both built on the foundation of questioning, infer and make judgment. Therefore, up to now, much of the research on inquiry-based learning is related to science teaching and learning. It is therefore not a surprising for people to overlook inquiry-based learning in non-science learning. It may explain why Dow (1996) warned that investigations in the physical sciences have dominated the discussion of the application of scientific inquiry to the field of education. Nevertheless, as Dewey has pointed out, human beings not only engage in science inquiry but also inquiry in other areas including social issue and other problems in daily life (Dewey, 1938b).

The third major issue about the definition of inquiry-based learning is the argument as to whether it is specific learning and teaching method or just an umbrella term which consists of many different approaches under the

philosophy and spirit of inquiry. Such confusion may simply emerge from the relationship between inquiry-based learning and one of its possible origins that is the theory of constructivism. In fact, the most widely quoted philosophical ground to justify the adoption of inquiry-based learning is built on the theories of constructivism. Eick & Reed (2002) directly point out that inquiry-based learning is a learning strategy based on constructivist theories of learning. Exline (1995) also agree that the strongest philosophical tie for inquiry-based leaning comes from the constructivist thought. Moreover, inquiry-based learning is also a socio-constructivist approach because of collaborative work within which the student finds resources, uses tools and resources produced by inquiry partners (Vygotsky 1978; Doise & Mugny, 1984), and can do so in collaborative contexts with the support of others.

One of the major theoretical contexts of constructivism is that any kind of knowledge is constructed rather than perceived through senses (Riegler, 2000). In practice, social constructivists advocate that real learning only happen when children construct their own knowledge by interacting with the environment and other relevant people (Brown and others, 1989; Steffe &Gale, 1995; Tishman and others, 1995; Anderson and others, 2000; Waxman and others, 2001). Although people disagree about how to achieve constructive learning, some common beliefs could still be generated among constructivists. They are:

1. Students learn best when they gain knowledge through exploration and active learning (Anderson, 1998), and through collaborative and social dimensions of learning (Wood, 1998).
2. The traditional model of teaching should be replaced by a much more complex and interactive one (Prawat & Floden, 1994).

3. Hands-on materials are used instead of textbooks, and students are encouraged to think and explain their reasoning instead of memorizing and reciting facts (Prawat & Floden, 1994).
4. The alteration of teacher's role from a knowledge transmitter to a learning facilitator (Bauersfeld, 1995). Altering the teacher's role from delivery of teaching content to facilitating student's learning also implies a change in the way teachers monitor and assess students. Holt and Willard-Holt (2000) stressed that under inquiry-based learning, the concept of assessment is a dynamic one. Rather than viewing assessment as a process carried out by one person, such as the teacher, it is seen as a two-way process involving interaction between both teacher and student. According to Willard-Holt (2000) the assessor should see assessment as a continuous and interactive process that measures the achievement of the learner and help improving his learning at the same time. Such an assessment concept are in fact similar to that of the medical science when medical practitioners apply diagnosis, treatment, assessment and further treatment until a satisfactory improvement to a patient's medical problem is detected (Fullen, Hill and Crevola 2006).

These beliefs are in fact affecting different curriculum movements, the "Learning to Learn" curriculum reform in Hong Kong and the Assessment for Learning in the UK are examples.

However, constructivism is not a particular pedagogy but rather a theory describing how learning happens, the pedagogy derived from it may therefore develop into different ways in practice. Hence, there are always different views and practices for inquiry-based learning. As early as in Burke (1964), inquiry has been defined as using sense-perception or other form of

experience to establish the truth of propositions. Burke further distinguished two types of inquiry:

1. Primary or basic inquiries, which do not require the use of propositions already accepted as true.

2. Secondary inquiries, which do need the use of proposition.

Shulman and Keislar (1966) then described a four-step model that involves problem sensing, problem formulation, searching and information gathering and problem solving. Sliberman and others (1972) added one characteristic to it: The whole inquiry process is under the control of the learners.

Since then, the process and procedures for inquiry as a specific learning or teaching method have been organized as many similar models. Examples could be found in Exline's (1995) three steps process of asking questions, making discoveries, and rigorously testing those discoveries in the search for new understanding and a more complete model of Harlen and Jelly, (1997) as they defined inquiry-based learning as seven constructive steps. They are: observing, questioning, hypothesizing, predicting**,** investigating, interpreting**,** and communicating**.** Recently, similar models or procedures have been adopted widely, examples could be found in Marshall and Dorward (2000) and Galileo Educational Network (2004).

Conclusively speaking, those who interpret inquiry-based learning as specific method, generally agree that there are at least four critical steps: generating hypothesis, collecting data, interpreting evidence, and drawing conclusions. They also share their common view in looking at inquiry or inquiry-based learning from an angle of science investigation. Inquiry-based learning is thus often described as models, which imply formulation of a series of steps in form of a cycle (Bishop et al., 2004).

Other than relative confined definitions, a looser or broader sense of inquiry is still adopted by different educationalists. For instance, Schostak (2003) supports a loose sense for the inquiry concept applied to different approaches to learning and the research based approach is only one of the approaches that could be included in the inquiry approaches family. Similar viewpoint could also be found in Kahn and O'Rourke (2004) as they add some characteristics of inquiry-based learning as follows:

- There should be a complex problem or scenario that is sufficiently open-ended to allow student to provide a variety of responses or solutions.
- The inquiry requires students to draw on existing knowledge and to identify their required learning needs or objectives.
- Tasks stimulate curiosity in the students, encouraging them to actively explore and seek out new evidence or find a new question.

The broader definition focuses inquiry-based learning on the environment or contextual factors for facilitating students' inquiry instead of delineating specific steps for the process of inquiry. As Gerstenmaier & Mandl (1994) point out, the inquiry conceptions actually involve a number of substantially different schools of thought. More important, Anderson raises a question to recent extensive use of the term "inquiry" as he asked:

> *Is everyone talking about the same thing when we use the word inquiry? If we got precise about its meaning, would we still be agreeing with each other? What does it look like in the classroom? What are the results?*
>
> (Anderson, 1998, p.16)

Additionally, in commenting the description of inquiry of the U.S. National Science Education Standards, Keys and Bryan (2001) hold that

> *Inquiry is not a specific teaching method or curriculum model. Multiple modes and patterns of inquiry-based instruction are not only inevitable but also desirable because they paint a rich picture of meaningful learning in diverse situations.* (p. 632)

The proposition raised in Keys and Bryan (2001) provides a room for the development of different inquiry-based learning or teaching methods to fit different learning content, especially for areas of non-science learning. It is because for those who accept a general or broader meaning for inquiry and inquiry-based learning, they usually see inquiry as a philosophy of learning, rather than some specific steps or procedures and such interpretation allows inquiry-based learning to be applied to a wider context and across disciplines beyond science learning.

As the definition and meaning of inquiry-based learning is inevitably varied (Anderson, 1998; Keys and Bryan, 2001), the local educational authority adopted a boarder perspective for inquiry-based learning. The CDC of Hong Kong describes her interpretation of inquiry-based learning as follows.

> *In the inquiry process, students are active constructors of knowledge and the teacher is a facilitator of learning. Inquiry is not so much seeking the right answer because sometimes there is none but rather, seeking appropriate solutions to problems.*
>
> (CDC, 2001, p.80)

Examining this description, the last sentence marks the spirit of this version of definition and they are also adopted as the definition of inquiry-based learning of the new PGS curriculum. Such a description may as well provide room for teachers to develop different teaching strategies, especially for the

non-science content inside the PGS curriculum. Since this study is aiming at discovering stories of PGS teachers during implementing the new PGS curriculum, the definition adopted by the CDC is also the definition adopted in this study. The CDC has not confined inquiry-based learning inside PGS curriculum to any science investigation model; rather they described the philosophical principles of what inquiry-based means inside the PGS curriculum. the researcher therefore employed the principles; "*teacher as facilitator*" and "*inquiry is not so much seeking the right answers*" as the two major elements that constructing the definition of inquiry-based learning in this study and they also stand as standard principles for comparing teachers' beliefs and teaching behaviour when implementing the PGS curriculum.

2.2 The argument on inquiry-based learning: The support side

In the camp of advocating inquiry-based learning, researchers suggest that there are evidences of the effectiveness and benefits of inquiry-based learning in improving students' achievements in various aspects. Recently, Lambert and Whelan (2008) report a study of the inquiry-based Earth systems curriculum and strategies for teaching diverse students backgrounds in five schools in a large, south eastern U.S., urban school district. The curriculum was implemented with 5th-grade students with varied linguistic, cultural, and socio-economic background. The research employed quantitative and qualitative data sources, including two assessments (i.e., a pre-and post-unit test as well as the National Assessment of Educational Progress [NAEP]/Third International Mathematics and Science Study [TIMSS] test) and an open-ended student questionnaire. By comparing the pre-test and pro-test, the result shows that all five schools showed

statistically significant improvements in their science achievement. Furthermore, the report also claims that 92 percent of the students thought that they had learned a lot of science from their study of the curriculum unit. 90 percent or more of the students at all schools, believed that they had learned a lot of science from the unit as a whole. It echoes other researchers' claims that inquiry-based learning improves students' achievement (e.g. Burkham, Lee, and Smerdon, 1997).

In other aspects of benefit, Kilinc (2007) introduced inquiry-based experimental activities on the teaching of photosynthesis to 24 pupils from Grade 3 at Atatürk Anatolian High school in Turkey. As data gathering material, 7 inquiry experimental study sheets, the pupils' opinions survey consisting of 6 open-ended question, and two-lesson-hour video records were used. Kilinc found that the pupils declared that the inquiry based laboratory activities were more permanent, more enjoyable, and more pupil-centred than the traditional methods. In addition, it is reported in this study that students studied cooperatively and were benefitted from different aspects of student-student interaction and that their attitudes related to biology increased positively. In fact, there are also findings claiming that inquiry-based learning was associated with benefits for students in various aspects. For examples, the ability to apply learning in new situations (e.g. White & Frederiksen, 1998) and foster positive learning attitude (Kilinc, 2007).

Nevertheless, most of these correlation studies about adopting inquiry-based learning and students' achievement raised complicated problems. The so-called inquiry-based learning methods in those studies were in fact different teaching and learning methods. Hence it raises the

question whether such correlation happens between all sorts of teaching methods grouped under the umbrella term inquiry-based learning or only applies to specific method. More important, those studies were actually looking for various objectives, for examples, the ability to apply learning (White and Frederiken, 1998), the attitude in learning (Kilinc 2007) and students' achievement in various subjects (GLEF, 2001; Lance, 2001). Hence, it is difficult to compare different target abilities with a series of loose defining activities which sit under the umbrella term, inquiry-based learning.

Another major ground buttressing the adoption of inquiry-based learning comes from the concept of skills acquiring. As earlier as Phoenix (1964) believed that:

> *If one possesses the tools of inquiry, he is not in need of a large store of accumulated knowledge.* (*Phoenix*, 1964, p.333)

Such supposition is widely deemed as the philosophical foundation for adopting inquiry-based learning for tackling the needs of modern life. Under similar viewpoint, Kahn and O'Rourke (2004) maintain that inquiry-based learning offers flexibility to develop a range of abilities and skills for tackling the challenge of the modern world. They also remind that modern economy places a premium on the ability to create knowledge; open inquiries allow the development of this and other key transferable skills. Besides, leadership skills in managing complex inquiries and projects are particularly important in employment. Such assumption implies a "learning to learn" spirit and is perfectly in conformity with the modern discourse in preparing children for the new era, and it has become the most appealing advocacy in

schools (Law and Wong, 1995). It also explains why schools of today tend to teach students to inquire rather than to accumulate information. Therefore, it has become a strong sociological and political justification for inquiry-based learning in the language of *"human capital"* (Becker, 1993) and *"social capital"* (Coleman, 1986). In fact, the new PGS curriculum in Hong Kong is one of the products produced under the "Learning to Learn" education reform (CDC, 2000) launched in year 2000. However, such uncritical acceptance of the "language of skills" (Halsey and others, 2001) in education has entailed criticism that it leads curriculum formation away from a principle based on teacher-student interaction according to students' needs towards a mechanistic, standardizing perspective (Halsey and others 2001, p.234).

In addition to above philosophical viewpoints, the major supporters for inquiry-based learning also come from the psychological field. In the perspective of cognitive development, Inhaler and Piaget (1958) denoted that the process of inquiry develops the capability of moving from the highly egocentric, intuitive and concrete concepts towards more decentralized, analytical and abstract thinking. They even announced that, there is no mode of mental activity in which these developmental trends are more evident than the process of inquiry. In analyzing the strengths of inquiry, Inhelder and Piaget also found that the activity of gathering and processing information is exciting and pleasurable. The ability to assimilate discrepant events is intrinsically rewarding. Besides, new meaning in old events creates in the learner a sense of power and finally, the immediate consequence of inquiry motivates learning.

On the other hand, motivation theorists also see the importance of

inquiry for children. Kaplan and Maher highlighted the need to identify:

> *...pathways by which students can construct the meaning of achievement situations and the purposes that they can adopt for engagement and success in achievement tasks.*
>
> (Kaplan and Maher 2002, p. 138).

Kuhn (2007) pointed out motivation resides not within the individual but in the interaction between individual and subject matter and such interaction is the basis for inquiry-based lessons. Similarly, Vansteenkiste et al. (2006) identified the value of inquiry activities as crucial step in *"accepting regulation of the activity as one's own"* (p.21). In fact, in the same direction, forty years ago Bruner (1961) and Alpert (1960) addressed themselves to the problem of motivating curiosity in schools and promoted a feeling of confidence through inquiry and discovery learning activities. At that period, Hunt (1962) also added that motivation is inherent in information processing and action. Even earlier, other theorists like White (1959) and Eriksson (1950) pointed out that the child who attains new understandings for himself gains a sense of intellectual power.

Although educational psychologists claimed that motivation and challenging tasks benefit children' cognitive development, the actual result depends very much on teachers. Because children cannot be motivated without a motivating environment and unless someone takes up the role to bring children to the challenging task, children would never even know there is an opportunity for them to exercise their mental power. Under such inference, there is still a major question for above-mentioned studies, whether it was the teachers' teaching that motivated the children or solely the

inquiry approach used? In fact, there are many examples of effective teachers motivating their students by including various activities in traditional non-inquiry lessons.

Apart from that, children' social development has also been quoted frequently as another psychological rationale for employing inquiry-based learning on children. Dyasi (2000) found that inquiry contributes to children's intellectual development as well as social development, since inquiry-based learning in school is carried out in social context. Children discuss plans and work collaboratively in carrying out inquiry activities. Dyasi found that these activities not only foster collaboration among children, they also help develop language and literacy capacity. The importance of social learning and peer interaction is also emphasized by other famous psychologist like Vyogtsky (Hickey, 1997; Saloman & Perkins, 1998; Slavin, 2004)

Nevertheless, when we examine various definitions of inquiry-based learning, it is not a must for inquiry-based learning method to involve group works or student-student interaction, although most of the previous experimental studies were done in group work situation. However, when we adopted a narrower definition of inquiry-based learning, they are steps for individual to inquire only. Hence, the advantages in social development claimed by social psychologists were based on a prerequisite that inquiry-based learning must be organized in an environment of rich peer interaction among students. Therefore, the benefits brought about by social interaction and collaborative problem-solving were based on the usual practice in group learning but not directly the theory of inquiry-based

learning. In other words, students could still learn individually with the principles of inquiry-based learning.

2.3 The arguments on inquiry-based learning: the challenge side

Within the theoretical arguments, both the philosophical and psychological rationales for inquiry-based learning have been challenged. Law and Wong (1995) argued that

> *The slogan that 'students construct their own knowledge' has apparently gained wide acceptance among many educational researchers and practitioners since the past decade, despite the fact that this statement in itself can give rise to different interpretations, not to mention its equivocal implications for pedagogical practice.* (p.73)

As Slavin (2004) pointed out, one of the major arguments for inquiry-based learning is the diversity of teaching and learning methods being adopted under this umbrella term. Gerstenmaier & Mandl (1994) also found that the constructivist and inquiry perspectives actually involve a number of substantially different schools of thought, and the current discussions are characterized by confusion. Newman et al (2004) also shares similar view, because various definitions of inquiry exist in the literature and in classroom practice; teachers face dilemmas during the study of inquiry. Hence, it is reasonable for Newman et al (2004) to conclude that given that researchers have used varied definitions of inquiry—definitions that also vary by contextual considerations—it is not surprising that teachers and educators struggle when deciding how to teach inquiry in their courses. As mentioned, the situation becomes more sophisticated when one frames inquiry within a constructivist paradigm in which reality is a socially and experientially

constructed entity and its form and content depends on those who hold the construction (Lincoln & Guba, 2000; Schwandt, 1997, 2000; Von Glasersfeld, 1996). The whole picture may be explained by Lebow (1993) when he commented that the theorists who support approaches built upon constructivist thought tend to confuse the role of constructivism as a philosophical orientation with that of instructional design as a method.

Whilst the interpretation of the term constructivism is multifaceted (Philips, 2000), the extent and usefulness to which constructivist theories can be considered a theory of learning, teaching or both has been questioned (Solomon,1994; Fox, 2001). Since the major theoretical basis for inquiry-based learning is in question, inquiry-based learning also faces great theoretical challenges. Furthermore, to equate the construction of knowledge by scholars in various academic fields with the learning activities inside schools has entailed sharp criticism. Seixas (1993) used the discipline of history as a case study, to compare and contrast the scholarly community of inquiry with the community of inquiry in the classroom and found that given too much interpretive leeway for students, they may construct and reinforce untenable views. Finally, Seixas suggested more teachers should be integrated into the scholarly community so that better the chance that teachers will understand the nature of historical inquiry, interpretation and debate. More important, if one frames inquiry within a constructivist paradigm in which reality is a socially and experientially constructed entity and its form and content depend on those who hold the construction (Lincoln & Guba, 2000; Schwandt, 1997, 2000; von Glasersfeld, 1996), then confusion appears. Under such circumstances, different teachers and students will construct their own working definitions of inquiry (Newman, JR. and

others, 2004).

Another major argument for the theoretical ground of inquiry-based learning is the debate over the necessity of prerequisites of possessing basic knowledge and skills before one can inquire (Airsian & Walsh, 1997; Harris & Graham, 1996, Harris & Alexander, 1998; Von Glaserfeld, 1996). In this aspect, Grotzer (1998) noted that inquiry-based learning can lead to many dead-ends. He articulated that teachers adopting an inquiry approach did help students learn a lot about the process of inquiry and what one must think about when trying to answer certain kinds of questions. However, they do not necessarily help children construct present-day understandings of how the world works. After all, individual scientists might spend an entire lifetime developing such knowledge. Thus, Kuhn et al, (2000) warned that

> *Inquiry learning could in fact be counter productive, leading students to frustration and to the conclusion that the world, in fact, is not analyzable and worth trying to understand.* (p. 496)

It may also explain why Vygotsky addressed the problem of striking a balance between children's constructing of understanding and their "*rightful inheritance*" to an accumulated wealth of scientific understanding (Hickey, 1997; Saloman & Perkins, 1998).

Furthermore, according to the psychological studies, effective inquiry-based learning depends on the intentions, self-monitoring, elaborations, and representational constructions of an individual learner who is intrinsically motivated. Seels (1989) raised the fundamental question as how to prepare such active, self-regulating and reflective learner and what to

do in case the learners do not possess these attributes. As in inquiry-based view, learning occurs not by recording information but by interpreting it, effective learning depends on the intentions, self-monitoring, elaborations, and representational constructions of an individual learner who is intrinsically motivated. As Seels (1989) saw that for a learner to inquire an individual needs a highly adaptive environment and should be viewed as an *"active, self-regulating and reflective learner*" (p.14). Therefore, Law and Wong (1995) argue that the use of such learning environments and methods may only be suitable for certain learning phases and in their studies it may be best used in higher-level learning.

Again, in the field of psychology, Kirschner et al (2006) criticize the inquiry methods on two major grounds that it produces cognitive overload and unproductive search in problem-solving settings. According to Kirschner and colleagues, it is because such minimally guided instruction approaches appears to proceed with no reference to the characteristics of working memory, long-term memory, or the intricate relations between them. Kirschner and colleagues also argued that any instructional procedure that ignores the structures that constitute human cognitive architecture is not likely to be effective. They concluded that most educators find it almost impossible to implement or reluctant to implement these minimally guided approaches because they require learners to engage in cognitive activities that are unlikely to generate effective learning. As a consequence, teachers may either ignore the recommendations or, at best, pay lip service to them (Aulls, 2002).

In the viewpoint of instructional design, Jouassen (1991) notes that in an inquiry-based lesson, the instructional goals and objectives would have to

be negotiated during the learning process rather than set a priori, and in this regard, there is no best way of sequencing instruction in an inquiry-based lesson. He further stated that the goal of instructional theory should then concern itself more with developing *"mental construction 'toolkits' embedded in relevant learning environments that facilitate knowledge construction by learners"* (p.12). As a result, designing instruction that can both accommodate individual motivations and goals as well as stimulate active knowledge construction constitutes a problem for current instructional design theory.

After discussing the theoretical controversy from viewpoints of both sides, one may not be surprised by the even greater concern about the effectiveness and applicability of inquiry-based learning in authentic classroom practice.

2.3.1 The challenges of inquiry-based learning in practice

Kirschner et al. (2006) maintain that advocates of inquiry methods confuse practicing a discipline and teaching or learning that discipline. It is a mistake, they said:

> *...to assume that the pedagogic content of the learning experience is identical to the methods and processes (i.e., the epistemology) of the discipline being studied.* (p. 84)

There is no basis, they claimed:

> *...for advocating learning a discipline by experiencing the processes and procedures of the discipline.* (p. 78)

According to Kirschner and others, not only is it theoretically unsustainable

to equate the learning of a discipline with experiencing the process of knowledge building of that discipline, but also it is not practical in classroom situation to do so. In fact, the worry of Kirschner et al. (2006) has been proved in research literatures.

In studying teachers, research found that inquiry-based learning places special requirements on them. Olson (1981) studied eight secondary science teachers as they were asked to implement an innovative inquiry curriculum, the Schools Council Integrated Science Project. Olson found that the language used in the curriculum functioned as a foreign language for teachers who attempted to translate it into a more familiar language of the classroom. Olson concluded that innovative doctrines create dilemmas for teachers. These dilemmas arise because, when teachers decide to adopt new practices, they face new uncertainties about their role in the classroom, the effectiveness of their methods and the purposes of their instruction. The Project proposals, initially seen by teachers as increasing the diffuseness of their work, were modified by them so that it was clearer to them what was to be accomplished and how it was to be done. The translation of the materials into more specific terms meant that important elements of the “doctrine”of the Project were either ignored or redefined in more traditional terms.

In the same aspect, Keys and Kennedy (1999) reported a detail case study. They adopted an interpretive paradigm to analyze the case history of one teacher, Ms. Kennedy, during her teaching of science units of light and weather during the 1996-1997 school year. Participants in this project also included a university assistant, Dr. Keys, and 26 children. Data were collected included field notes of the class during science instruction, filed notes written after informal interviews with Ms. Kennedy and the students

and transcripts of three formal interviews with Ms. Kennedy. Dr. Keys also observed Ms. Kennedy during 28 of the total 57 science lessons. The report discussed an elementary teacher's difficulty balancing inquiry-based instruction with district-mandated curriculum and assessment strategies. Challenges identified by Ms. Kennedy included (a) lack of time; (b) turning students' questions back over to them ; and (c) teaching district mandated concepts which she felt too abstract and therefore could not be taught through inquiry approaches. The findings also show that Ms. Kennedy invented her own approach to inquiry teaching that fit with her personal views of the science curriculum and the role of the teacher. Such a finding represents a significant departure from previous studies in which teachers adopted an inquiry curriculum superficially, and then continue to teach in traditional ways (Welch etal., 1981; Olson, 1981)

Another significant research for the challenges of inquiry-based learning in practice comes from Holbrook and Kolodner (2000) as they reported their findings through the "Learning by Design (LBD)" project (Kolodner et al, 1998, Hmelo et al, 2000) which is an NSF-funded effort to promote the development of inquiry-based science classrooms in contemporary school settings. By using five years, they have supported the development and implementation of LBD units by 25 teachers. All implementations have taken place in public schools, and they have made sure that the implementations included a wide range of settings and backgrounds. They have used many methods to evaluate the success of the curriculum, including frequent discussions with implementing teachers and their supervisors, ethnographic observations in the classrooms, student surveys and interviews, analysis of the development of student's metacognitive skills and science

thinking, assessment of student learning both through standardized test items in a pre/post-implementation design using matched comparison classes, and results from performance-based assessment tasks. They have also discovered following problems: (i) Teachers find it difficult to help students learn science concepts at the same time they are being introduced to the processes involved in designing, doing science, communicating, collaborating, and so forth. Teachers prefer that students have some minimal expertise with these complex processes before using them to learn science content. (ii) Students are not used to the kinds of collaboration, communication, and learner-centred skills that we want them to use in the classroom; they need time to get comfortable with being active learners. In addition to that, they identified a set of related problems that seemed to be impediments to inquiry-based learning, they are:

1) Groups too often did not work well together.

2) An artifact might be successfully completed by a group without the individuals all understanding the rationale for its design, the method of its construction, or how it embodied the science.

3) Students needed a great deal of help with the scientific method and with understanding the advantages and disadvantages of models.

4) Teachers had difficulty changing their view of projects as capstones to projects as motivators for learning.

(p.223)

Finally, they recommend that it takes at least two or three years for a teacher to manage an inquiry-based lesson well. It is also the reason justifying the timing of the present study that the present study was taken place three years

after the implementation of the new PGS curriculum.

Following up the Learning By Design project, Fasse and others (2001) studied the importance of establishing a specific LBD classroom culture by using a combination of qualitative (focused observation, interview, self-report) and quantitative (performance assessment, content tests) methods. Their targets were four teachers in four middle schools in metropolitan who were volunteered to try it out in their classrooms. During the study, they discovered many practical needs in putting together an inquiry curriculum approach that can be broadly adopted. They included:

- Teachers have to be familiar with inquiry.
- Teachers have to get used to being facilitators.
- Teachers and even students have to get accustom with the way helping each other to learn instead of learning individually.
- Students have to think all the time during inquiry.
- Teachers have to know the connection between the inquiry activities and the learning content.
- Teachers have to understand that deep learning require iterative application, feedback, explanation, and revision.

In addition, teachers reported that they also needed help in (a) creating an inquiry-based classroom culture; (b) keeping up with the rituals and expectations as they occur; and (c) converting their thinking and practices from traditional methods to something new. One important aspect discovered in this study is the role of school culture in implementing inquiry-based learning. Teachers in the study admitted that creating culture is critical to the success of the project and this requires extensive "*retooling of teacher habits*".

One year before the report of Holbrook and Kolodner, Edelson and Gordin (1999) explored the challenges of adopting inquiry-based learning in classroom, through a program of research on the use of scientific visualization technologies to support inquiry-based learning in the Geosciences. The design and evaluation were conducted using an informal, collaborative approach. Design was done by teams at Northwestern University that included faculty in education and computer science, graduate students, professional programmers, and practicing teachers. 353 students and 14 teachers attended the project. Input and feedback were sought frequently from content area scientists. Use of the software and curriculum were observed both in classroom and laboratory settings. Records were collected through a combination of direct observation by the research team, videotaping, interviews and journals of teachers and students, and unsolicited feedback from teachers. The researcher identified five significant challenges to implementing inquiry-based learning and presented strategies for addressing them through the design of technology and curriculum. The five challenges are:

1. Motivation. They found that the challenging and extended nature of inquiry requires a higher level of motivation on the part of learners than is demanded by most traditional educational activities.
2. Possession of investigation techniques. Students must know how to perform the tasks that their inquiry requires, they must understand the goals of these practices, and they must be able to interpret their results.
3. Background knowledge. Students need the science content knowledge when they are required to formulate research questions, develop research plan, collect, analyse, and interpret data. Furthermore, in designing

inquiry-based learning, the challenge is providing opportunities for learners to both develop and apply that scientific understanding.

4. Management of extended activities. To achieve the ultimate goal of open-ended inquiry, students must be able to organize and manage complex, extended activities.
5. The practical constraints of the learning context. Inquiry-based learning must fit within the practical constraints of the learning environment, such as the restrictions imposed by available resources and fixed schedules.

This project was obviously done to older learners, thus one can imagine the situation for primary students to engage to similar learning and teaching approach and face similar challenges. The findings of these projects echo the report made by Crawford (2000) and Lederman & Niess (2000) when they studied elementary teachers and have found that teachers lack an understanding of inquiry and do not have the skills or experiences to effectively teach through inquiry. Actually, it has been raised by Naylor & Keogh (1999) that it is not obvious how the theory can be implemented in classroom and that specific guidance on how to teach in an inquiry manner is not well documented.

On the other hand, for the challenges in learner's side, Van Glaserfeld (1992) argues, constructivist learning approaches suggests that teaching is a social activity, but learning is a private act with understanding being constructed by each individual "knower". The challenge for the teacher then becomes one of how best to facilitate learning within the learner's framework of reference. Furthermore, Elen & Lowyck (2000) found that the more open the learning environment is, the more self-regulative students have to be, and the more they have to be instructional designers for

themselves and it is not an easy job for them. It is echoed in Kuhn *et al.* (2000, 2004) as they discovered in their experiment that learners focus exclusively on outcomes and not on the analysis methods for finding the outcome and such habits of learning hinder children's inquiry-based learning. Grotzer (2000) reminded that the translation from theory to practice contains many possible stumbling blocks. The largest stumbling block has to do with helping students to build understandings that will serve them well in today's world. He articulated that:

> *Such issues are similar to questions raised in response to the Discovery-Learning movement of the 1960's. Students were encouraged to engage in hands-on tasks to discover science principles. Too often, students didn't have a clue as to what they were doing and why.* (p.130)

Buck and Stucki (2001) also observed that many students, who are attempting to learn by themselves with little direction from teachers, are overwhelmed, uncertain of how to begin, and grasping at the air. Another major criticism comes from the difficulties of students in constructing explanations after or during the inquiry-process. In fact in earlier time, Driver (1985, 1996) found that students generate incoherent explanation from personal ideas. Kuhn also observed that students are not able to make logical relationship between evidence and explanations (Kuhn et al., 1988). Similarly, Anderson (1986) concluded that students tend to use linear causal reasoning and attribute the cause of a phenomenon to the existence of an agent. Although most of these mentioned studies were done on science lessons, comparable situation would logically happen in non-science learning content. In addition, these challenges for students are in fact also the challenges to teachers, as they have to help their students to overcome such

challenges, so as to implement the inquiry-based learning successfully.

Concluding the difficulties and challenges found in above researches, they could be grouped into two main areas. First, the contextual factors, for instances, resources, teaching time, facilitates, culture and habit of teachers and students. Second, the pedagogical requirements of inquiry-based learning as applied on students and teachers, for examples, background knowledge, skills in inquiry and training in managing inquiry activities. Such a conclusion contribute to the establishment of the theoretical framework of the study, as it is inferring that inquiry-based learning poses major challenges to teachers due to the contextual factors of different educational environment and its special pedagogical requirements for teachers and students.

2.4 The crucial factor in implementing inquiry-based learning: teacher's belief

So and others (2005) found that the actual context of an inquiry-based lesson depends very much on teachers themselves regarding their beliefs, abilities and interpretations of the curriculum. Similarly, Hakkarainen (2004) studied 10-year-old and 11-year-old children and found that inquiry does not emerge spontaneously from pupils, but has to be intentionally cultivated by teachers. It has also been found that one important factor that could affect students' development of inquiry skills is teachers' instruction (Eick & Reed, 2002; Rop, 2002). In fact, teachers play various roles in preparing and facilitating students in inquiry-based learning. These roles include modeler, guide, diagnostician, facilitator, mentor, and collaborator (Crawford, 2000; Osborne & Freyberg, 1985). Starting from examining the importance of teacher, researchers proceed to study various internal factors that have

affected teachers' behaviour. Among these factors, "belief" is thought to be the best indicator of the decisions individuals make throughout life (Bandura, 1986).

The study of Nespor (1987) marks a critical step in emphasizing teachers' belief in studying teacher's teaching behaviour. Nespor's Teacher Beliefs Study Project was an intensive two-year programme. Eight teachers in three school districts (city side, countryside and middle burg) were video-tapped over the course of a semester and were interviewed for a total of more than 20 hours using a variety of techniques, including stimulated recall and other in-depth interview techniques. Nespor found that the function of teachers' beliefs is most significant for teachers to define their teaching tasks and organize the knowledge and information relevant to those tasks. He also remarked that teachers' beliefs is a deep-structured system with an affective and evaluative character has implications for the important role of teacher's belief in influencing teacher's actions in the ill-defined working context, especially because of the uncertainties brought about by curriculum innovations. Naspor proposed substantial suggestions that if teacher's beliefs are ignored, the system of practices they guide or make sense of will be correspondingly opaque. He analyzed that

> *At a deeper level, failing to attend to beliefs leaves the researcher in the position of being able to develop only an abstract model of the regularities or structures underlying classroom processes—the functions and uses of classroom structures, and the social "rules" governing their use, remain hidden. (p.3)*

Hence, according to Naspor, teacher's belief is the most valuable element in assessing any hidden system of a teacher's action. Archer's (1999) study

confirms such a proposition. Archer studied the links between beliefs and practices in the teaching of mathematics at both the primary and the secondary level. In all, 4 primary schools (17 teachers interviewed) and 3 high school mathematics departments (10 teachers interviewed) from schools of New South Wales were visited. Archer used rather open interview questions so as not "*to lead the witness*". His intention was to elicit teachers' spontaneous thoughts rather than to have them respond to predetermined areas of interest. Teachers' responses were categorised in four ways: practices related to their epistemological beliefs; practices related to their beliefs about motivation; practices related to their beliefs about pedagogy; and attributional beliefs that were not tied to specific teaching practices. Archer also found that teaching decisions are based on deeply held beliefs about teaching that were formed when teachers themselves were students, or, as beginning teachers, assimilating the attitudes and behaviours of their more experienced colleagues. Archer added that beliefs, once firmly established, are difficult to change: like everyone else, teachers selectively choose information that confirms their beliefs, even to the point of distorting evidence to make it fit. Archer's findings fit with other researches results. Those findings indicating that teaching decisions tend not to be the result of a conscious selection of a theory of learning and resulting teaching strategies (eg, Pajares, 1992), or thoughtful application of a body of professional knowledge acquired during teacher preparation courses, in-service days, or post-graduate study, but rather teachers' personal beliefs in teaching and learning (Korthagen & Kessels, 1999). Such a supposition poses a challenge to the policy makers or curriculum reformers, for instance, the maker of the new PGS, the CDC of Hong Kong. Because it implies that

no matter how much effort have been put forth by the authority in writing up the curriculum document and installing resources, the actual result of a new curriculum may still in a great extent determined by the beliefs the teachers already hold.

Nevertheless, the discussion about the importance of teacher's belief must take into account the ambiguity of the concept "belief". The notion "belief "is in fact problematic (O' Loughlin, 1989). There are also various definitions for the concept "belief" and they are basically viewed from the angle of psychology and they at least include the following. Rokeach (1968) defined "beliefs" as inferences made by an observer about underlying states of expectancy. Abelson (1979) deemed that "belief" is individual's personal knowledge for a particular purpose or under necessary circumstance. Nisbett and Ross (1980) treated "belief" as the reasonably explicit propositions about the characteristics of objects and object classes. Similarly, Brown and Cooney (1982) believed that "beliefs" are dispositions to action and major determinants of behaviour and such dispositions are time and context specific. It is also the mental constructions of experience which condensed and integrated into schemata or concepts that are held true and that guide behaviour (Sigel, 1985). Parajes (1992) asserted that "beliefs" involve the incidental learning process that an individual undergoes through observation, participation and imitation of the cultural, elements in the individual world.

Among the various interpretations of belief, the analysis of Sigel (1985) has been quoted widely. Sigel suggests that beliefs are socially constructed representational systems that people use to interpret and act upon the world. According to Sigel, beliefs may or may not evidentially base. Those beliefs are not evident based are more likely to be resistant to change. Further,

beliefs may be conscious or unconscious, with the latter being in evidence only when people are asked to apply their existing interpretive framework to novel situations or stimuli. Such assertions provide ground for examining teacher's belief by studying their performance in a newly implemented curriculum. Furthermore, Sigel advanced a structural model of beliefs. It indicates hypothesized components that link together various interacting factors that appear to lead people to act the way they do. The hypothesized components of the belief-action process are

(1) The sources of belief.

(2) The effect of agents that induce change in belief.

(3) The core beliefs people hold about an issue.

(4) The belief about praxis that is the beliefs about means-ends.

(5) The contextual influences on belief formation and practice.

(6) The theories-in-action or in other words the implicit rationales behind actions.

(7) The outcome of those theories-in-action that is the observed effects on student development, learning and performance of the specific style of practice adopted by the teacher.

Following up Sigel's model, O'Loughlin (1989) interpreted the components as different aspects for studying teacher's belief (as shown in table 3.2 in the methodology chapter). He remarks that the investigation of such belief components requires a combination of observational and interview technique. Such a combination describes teacher' actions and the rationale for their actions. O'Loughlin's suggestion is also adopted in this study for the methodological purpose as in the present case study; interview and observation are major tools for investigation. O'Loughlin added that

contextual factors contribute to the maintenance and perpetuation of the belief system of teachers. According to O'Loughlin, the belief system or epistemological atmosphere is composed of the explicit and hidden curriculum of the school, as well as the not-so-hidden curriculum underlying standardized tests, curricular documents and mass-produced worksheets. In fact, O'Loughlin found that teachers who hold divergent beliefs about teaching and praxis may be thwarted from implementing them in practice due to constraints imposed by school administrators or by the imposition of standardized curricula and testing programmes. The importance of contextual factors and hidden curriculum proposed by O'Loughlin also provides useful focuses, especially in deciding to adopt a qualitative case study method as the major methodology in this research.

O' Loughlin's proposition is echoed in McNeil's (1986) in the research into the effects of institutional constraints on the practice of teaching. McNeil observed a number of traditional, didactic classes which were obviously boring and sterile for students. In subsequent interviews with the relevant teachers, McNeil found that many of them were in fact bright, articulate teachers who have creative ideas and were enthusiastic about teaching the subjects. They just learnt to become boring and didactic. Loughlin explain the McNeil's study in terms of Sigel's model that,

> *Contextual factors drive these teachers to detach one portion of their belief system-that pertaining to the practice of teaching-and to construct an impermeable boundary around it in order to enable them to cope with the dissonance of having to act in a manner inconsistent with their overall belief system.*
>
> (O'Loughlin, 1989 p.7)

Hence, among the seven hypothesized components of Sigel's model,

contextual factors worth more attention when studying teacher's belief in specific educational environment. Therefore, contextual factors of the studied targets were specially focused in this study.

Furthermore, the adoption of the hypothesized components of the belief-action process of Sigel and the focus of contextual factors proposed by O'Loughlin goes in line with previous finding from the literature about teacher's belief and the importance of contextual factors in studying the implementation of an inquiry-based curriculum. In fact, Sigel's model and O'Loughlin's interpretation provide useful reference for studying the all-round aspects of teachers' belief in the present study. It helps to understand the linking of various factors interacting together to impact the final action of a teacher. Sigel's model is therefore taken as the major frame of references for studying teacher's belief in this research.

2.4.1 Divergence between beliefs and actual practice

Extending Sigel's (1985) focus on the importance of the contextual influences on belief formation and practice and O'Loughlin's (1986) finding of contextual factors contribute to the maintenance and perpetuation of the belief system of teachers, other researches found that teachers not always act according to their beliefs because of contextual constraints. Aldrich and Thomas (2002) evaluated the diverse constructivist beliefs of teachers from different sections of formal education, by using 27 prompts in a written test including the difference in student interest, difference in student development, motivation in exploration, informal conversation with adult, social skill development isolating curricular areas and working alone. They have found that almost all the target teachers show tendencies of positive

belief about constructivism, and yet, they found that such positive attitude does not necessary bring to a support to the inquiry-based learning approach. That means such teacher's belief may not bring out action.

In studying the factors that hindering teachers from acting according to their beliefs, Ross (1979) investigates three kindergarten classrooms and identifies four factors that seem to influence that relationship. Information about the classrooms was collected using the classroom disclosure approach, a form of educational criticism that combines and adapts methods from ethnography and aesthetic criticism. Observation, interviewing, and the collection of artifacts were the major tools of investigation. In the study, Ross identified factors that appear to influence teachers' ability to practice based on their beliefs. They are: (1) clarity of beliefs; (2) the ability to perceive connections between beliefs and practices; (3) awareness of alternative practices; and (4) perceptions about the beliefs of school system officials. In similar focus, Duffy and Anderson (1984) studied 8 reading teachers. They found that only 4 of them delivered instruction consistent with their beliefs. Factors cited which constrain teachers from teaching according to their beliefs include the need to follow a prescribed curriculum, lack of suitable materials, and students' ability level. Pennington, et al. (1996) also found differences between teachers' belief about teaching writing and their actual classroom practices. Using a questionnaire in which teachers reported their ideal and actual classroom practices, Pennington, et al., compared ESL teachers teaching at tertiary level in five countries in the Asia-Pacific region. Among the teachers from Hong Kong, Singapore, and Japan, a gap existed between the teachers' perceptions of ideal classroom practices and their reports of what actually occurs in the classroom.

Pennington, et al. (1996) attributed this gap between the ideal teaching, which implies teachers' beliefs, and actual classroom practice to the following constraints:

1. Students' level of English, motivation, and expectations about teaching or learning;
2. Teachers' knowledge and perceptions about writing practice;
3. Environmental constraints of class size, workload, time, and external requirements, such as examinations or other syllabus requirements.

Such findings confirm earlier result obtained by Duffy (1982) as he described the classroom as a place where teachers faced a variety of constraints including social forces within the classroom; External constraints such as prescribed textbooks and materials, pressures to "teach to the test," and expectations from parents and the community; and "Role Strain." Such constraints have been supplemented by Morris (1995) that in Hong Kong other than teachers' beliefs, there are a number of factors exerting a powerful influence on the pedagogy used. These factors include:

- Textbook
- Resources constraints
- Classroom control
- Examination
- Subject cultures
- School cultures
- Teacher isolation
- Career factors

As a matter of fact, the complexity of the real classroom situation assumes many limitations and constraints; therefore the result of inconsistencies

between teachers' beliefs and the classroom practices should not be surprising.

In short, there is ample evidence that teachers' beliefs can be crucial in a curriculum innovation (e.g. Brown and McIntyre 1982, Richardson, 1991). Yet, positive belief towards an innovation may not be an accurate predictor of successful implementation of an innovation (Morris, 1995), because teachers not always act according to their beliefs and there are still factors and situations driving teachers' actions in selecting teaching methods. After all, Cheung & Wong (2002) analyzed that the impact of teachers' beliefs on teachers' actions is inevitably mediated by numerous contextual variables (Bennis, Benne and Chin, 1985; Clark and Peterson, 1986), as well as other teacher belief systems (Bunting, 1984; Shen, 1997). Such findings contribute to the theoretical framework that it is important to look at the roles of contextual factors as constraints which hindering teachers from acting according to their beliefs.

2.5 Relevant studies in local context

After referencing to the literatures concerning the issues about inquiry-based learning and teacher's belief, another inevitable piece of reference is the relevant research results in local context. So (2003) studied the science inquiry ability of Hong Kong primary students in a science project event held in 2002 in Hong Kong. 24 written records of investigations by primary students were studied to explore children's cognitive processes in scientific investigations. Data were gathered by the observation and analysis of children's writings. 24 groups, each with 3 to 5 Primary four to six children were studied. The children's written reports of

their science projects were analyzed to examine the scope of process skills they performed and their understanding of scientific ideas. Although difficulties for teachers and students were reported, the positive results include (1) students found the process of scientific inquiry demanding but fruitful. (2) Students engaging intellectually with meaningful experimental experiences and data could construct shared understanding of scientific concepts in a community of learners. (3) Children could develop scientific understanding at different stages of the investigation: some were able to produce new ideas based on their previous learning; some acquired new knowledge from books and websites; some gained a deeper understanding through their experiments; some achieved understanding in making their conclusions.

Chau (2008) reported another case study on a two phases inquiry-based learning projects about the research skills of grade four students. The project was undertaken by 141 grade four students (about nine to ten years old), each phase lasting for two to three months. The projects were led by general studies teachers and heavily supported by Chinese-language teachers, the information technology teacher, and the school librarian. Through analysing the lesson plans, in-class exercises, homework assignments, written reports, presentations by students, and data collected through surveys and interview, the result shows following positive effects of inquiry-based learning approach. First, inquiry-based learning offers students an enjoyable and challenging learning experience while enhancing their knowledge and skills through close collaboration of the teaching staff and parental support. Second, it improves students' research skills and third, it enhances student's knowledge on their research topic.

In spite of these positive results about inquiry-based approach in science learning, reading and writing, deviated results were also found. So and colleagues (2005) investigated the pedagogical design of IT-Supported inquiry learning in PGS and have found that aside from the question of the theoretical effectiveness of inquiry-based learning, there was report about the practical challenges of putting inquiry-based learning into local primary classroom. When So and colleagues (1999) studied the teaching of PGS as an "integrated" subject in Hong Kong primary schools, they discovered that teachers were disappointed with insufficient provision of teaching strategies and information on the teaching and learning process of the subject. When teachers were asked to rank their preferences on the choice of training courses to support their teaching of PGS, they preferred to have training courses on teaching strategies (93%) and teaching activities (85%), as well as enrichment courses on teacher subject knowledge (62%).

Furthermore, So and colleagues conducted another study in 1998 on PGS teachers. They revealed that:

1. Teachers' knowledge on science subject is inadequate.
2. Teachers lack experience in organizing science experiments and science investigation activities.
3. Teachers have difficulties in guiding students to learn science.
4. Most of the PGS teachers are women and 69% of the PGS teachers come from an Arts subject academic background.

Such findings sounded a warning because science inquiry is the essential portion in the new PGS inquiry-based curriculum and the techniques used in science inquiry have many similarities with the inquiry-based teaching in other PGS areas (Harlen and Jelly, 1997). So (2002b) also reported that

learners in Hong Kong primary schools were infrequently invited to engage in scientific inquiry, and that they were not observed making suggestions about the direction that the activity or experiment should take.

The above-mentioned studies reflect that the PGS, no matter it is the new one or the version before 2004, is a problematic subject in local primary classroom. It may be due to the teachers' training, the design and nature of the curriculum or other constraints. Coupled with the fact that it is a culture and habit of local teachers to adopt a traditional teacher-centred approach in teaching (Morris and Marsh, 1991), one could predict the difficulties of the demanding new inquiry-based PGS. However, up to now the studies on this problematic subject are comparatively confined. Apart from those studies mentioned earlier, there are also researches in the technology content of the PGS by Fung (1999) and study in the science learning of the new PGS by Lee and Ng (2005). Teachers' beliefs as the crucial factor in affecting the implementation of inquiry-based learning, has not yet been explored in local context, especially for the new PGS subject. As a result, the present study is planned to investigate the stories and phenomenon of the impacts of teachers' beliefs in implementing inquiry-based learning of the new PGS.

2.6 Summary of the literature review

Research results show that there is ambiguity in defining inquiry-based learning. There are also arguments on the strength and effectiveness of inquiry-based leaning, in both theories and classroom practice. Within the practical challenges, difficulties arise from pedagogy requirements and other contextual constraints become the major obstacles teachers face and the major concern for the success of implementation of the inquiry-based

curriculum.

On the other hand, there is ample evidence that the concept of "teachers' beliefs" has been accepted by different researchers as the best indicators of teachers' decision about their actions (Bandura, 1986). Teacher's belief has also been found playing crucial role in implementation of any new teaching method especially in a demanding inquiry-based curriculum like the PGS in Hong Kong. The problem becomes even more complicated as there are also studies indicating that, teachers' beliefs and teachers' actions are not necessary linked. The literatures illustrate the problem of contextual constraints for teachers' actions articulated this point.

In addition, although there are some researches in inquiry-based learning as implemented in Hong Kong and about the new PGS subject, an inquiry into the crucial factor (teachers' beliefs) which affecting the implementation of inquiry-based learning in local primary schools has hitherto been ignored. Such discrepancy in the theories of inquiry-based learning and teachers' belief becomes the foundation of this study. Furthermore, as discussed in the research of Holbrook and Kolodner (2000), it takes at least two to three years for a teacher to manage inquiry-based learning, therefore a study is proposed after three years of the implementation of the new inquiry-based curriculum, the PGS.

2.7 A theoretical framework

Concluding the findings from literatures about inquiry-based learning, teachers' belief and the situation of Hong Kong PGS, following interrelationship has been inferred. Starting from that, various components in this study have been integrated as a theoretical framework. Figure (2.1)

explains the major areas of arguments concerning this study:

1. The theory of inquiry-based learning is still under strong controversy and one major argument is the practical effectiveness and applicability to authentic classroom situation due to various contextual constraints and special pedagogical requirement.
2. It is assumed that teachers' beliefs would affect their action in implementing inquiry-based learning (e.g. Nespor, 1987; Archer, 1999). Yet, literatures also show that teachers not always act according to their beliefs since the impacts of teachers' belief on teacher's actions is inevitably mediated by numerous contextual factors (e.g. Ross, 1979; Morris, 1995; Cheung &Wong 2002).
3. When examining the content of teachers' beliefs, Sigel's (1985) hypothesized components of the belief-action process provide useful reference, especially in the value of studying the contextual factors that influence the belief formation and action of teachers.
4. Therefore, studying contextual factors of individual school become crucial in both examining the implementation of inquiry-based learning and the impacts of teachers' belief in such implementation in the school.

2.8 The research question

Embedding the theoretical framework into the context of Hong Kong primary school and the new PGS curriculum, the research question has thus been organized as:

How do teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum? A case study of two primary schools in Hong Kong.

Under this research question, the following sub questions are explored, specially referring to the PGS teachers and the schools under study:

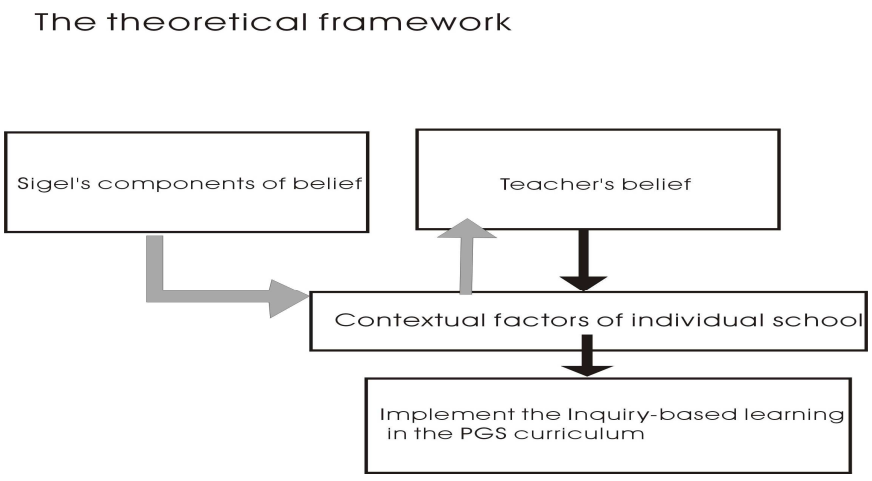
1. What are the teachers' beliefs in inquiry-based learning?
2. What are the impacts of teachers' beliefs on the implementation of inquiry-based learning in the PGS curriculum?

The first two questions address the theoretical framework about the content of teacher's belief in inquiry-based learning and the effects of such beliefs on the implementation of inquiry-based learning.

3. What are the contextual factors affecting teachers in the implementation of inquiry-based learning in the PGS curriculum?
4. What are the different impacts of teachers' beliefs on the implementation of inquiry-based learning in the PGS curriculum, in the two schools with different background?

The third and fourth sub questions address the theoretical framework about the importance of contextual factors in affecting teachers when adopting inquiry-based learning in the PGS curriculum.

Figure (2.1) The theoretical framework



Chapter 3

Methodology

3.1 Qualitative case study: an introduction

After considering the nature of the study, the qualitative design was selected for its interpretive function, its flexibility, depth and detail in studying the selected issues. The major methodology chosen for this study is the qualitative case study. Yin (1994) defines case study as:

> *...an empirical inquiry that investigates a contemporary phenomenon within its real-life context…* (p.13)

Merriam(1998) on the other hand illustrated a qualitative case study as an:

> *……intensive, holistic description and analysis of a single instance, phenomenon, or social unit*. (p.21)

The following paragraphs explain how this qualitative case study method is justified for this study. It also explains the tools and procedures used for data collection, the methods for data analysis and how the study was actually delivered in the targeted schools.

3.1.1 Qualitative case studies and the research question

As the research question has been framed as *"How do teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum? A case study of two primary schools in Hong Kong"* the following sub areas were explored in turn:

1. To identify PGS teachers' beliefs towards inquiry-based learning.

2. To detect the impact of teachers' beliefs on the implementation of inquiry-based learning in the PGS curriculum.
3. To identify the contextual factors affecting teachers' implementation of inquiry-based learning in the PGS curriculum.
4. To compare and contrast the findings through case studies of two schools with different background.

As Merriam (1998) remarks, the decision to focus on qualitative case studies usually stems from the fact that

> *the researchers are interested in insight, discovery, and interpretation….* (p.28)

Shaw (1978) suggests that case studies:

> *…concentrate attention on the way a particular group of people confront specific problems…* (p.2)

It explains the selection of the qualitative case studies approach for studying these sub areas. The researcher was interested in the inside stories of how the beliefs of the particular group of people (the PGS teachers) affect the implementation of inquiry-based approach in a new curriculum and he also aimed at interpreting these stories and comparing stories at different sites.

Yin (1994) also agree that for "how" and "why" questions the case studies method has a distinct advantage. The function of qualitative case study thus aligns with the research question. Furthermore, teacher's beliefs are kind of psychological construct. It would be more appropriate to inquire under a naturalistic inquiry to reach the naturalistic generalization (Lincoln & Cuba, 1985; Stake, 1995). Further consideration in selecting the

qualitative method includes:

1. The qualitative design was employed for its interpretive function in studying the problem (Maxwell, 1996), its flexibility in allowing various methods to study the problem in depth and detail (Patton, 1999).
2. As the researcher is hoping to reveal the real life context and the stories behind them, such context was not possible to be controlled by a scientific research environment in which variables are controlled and identified.
3. The data collected were mainly dialogues, school documents, and observational records. They were also difficult to be transformed into numbers or merely statistical representation.

In addition, with reference to the relevant studies in relevant researches, one will find that many of them were also done with the approach of qualitative case studies. Examples could be found in studies of So & Tsang's (1998) study on PGS teachers, Lee's (1999) study on inquiry-based learning for secondary Chinese teachers and Chan's (2003) study on secondary school teachers for their beliefs in integrated subject teaching. The common characteristic for these studies is that they were looking for the stories in real school life by collecting and analyzing various data at the sites.

Further, multiple case studies approach appears to be a trend in studying inquiry-based learning. For example, Apedoe (2007) used a synthesis of multiple cases studies of students' engagement to study the inquiry-based learning activities in a geology course. Similarly, McDonald and Songer (2008) also adopted a multiple case qualitative case study for two critical cases of teachers enacting a technology-rich inquiry-based curriculum focused on the development of complex reasoning around

biodiversity for fifth graders. Comparable example can also be found in Hume and Coll (2008) as they also adopted a multiple case study approach when studying the reality of classroom-based inquiry based learning in science for high school students.

Unlike these quoted researches, this study not only focuses on science learning, but also on inquiry-based learning in non-science context. As it has been discussed, Dow (1996) warned that investigations in the physical sciences have dominated the discussion of the application of scientific inquiry to the field of education. The discussion on inquiry-based learning in non-science areas is rare especially in context of Hong Kong primary schools. In fact, the PGS consists of six streams of content; science learning is only one of them. Others include Chinese culture and national identity, human and environment, society and citizenship, healthy living and the information age and global issues (CDC, 2002). Besides, the above-mentioned studies seldom selected the extreme or deviant cases or cases with maximum variation. Yet, this study selected cases with maximum variation and deviant situation. According to Patton (1990), the researcher adopted a non-probability sampling in which following purposeful criteria can be considered. They are:

1. Extreme or deviant
2. Typical
3. Maximum variation
4. Critical

In this study, the two target schools were selected for their maximum variation in rationales of educating children. School (A) emphasizes academic achievement and discipline of children, while school (B) focuses

on a balance development of children, or in other words, they try to foster children' cognitive, social and emotional development. Hence, the selected cases should provide variation and unique contextual factors for the study. In addition to that, the target teachers being selected for observation were also chosen by their variation in beliefs towards inquiry-based learning. Since inquiry-based learning is a kind of child-centred approach, schools with different rationales in educating children might have different interpretations and attitude towards such learning approach. Patton (2002) reminded that the inconsistencies of findings provide the opportunities for deeper analysis into the interrelationship between the phenomenon under study and the research methods being used. In addition, obviously, in this study, a single case is not enough, because the inquiry-based curriculum may produce different stories in schools with different commitment levels in supporting a new child-centred curriculum. Therefore, in order to enhance the validity, a multiple case study approach was adopted.

3.2. The basic design of the research

Figure (3.1) and table (3.1) explain the basic design of this study. The first step initiating the study was the construction of the theoretical framework through studying relevant literatures. Then according to the nature of the study, the researcher decided on the proper methodologies used. Also referencing to the relevant studies, the researcher selected target cases for studying. In this study, two samples with typical and maximum variant nature were selected, according to the information posted on the web site of "Primary School Profile (in Chinese version) " published by the Committee on home-School Co-operation of Hong Kong. After selecting

the cases, the researcher approached the principals of these schools and had informal interviews with the two principals. At almost the same time, the researcher developed the tools for data collecting by considering the various features suggested in relevant studies about detecting the performance of inquiry-based learning. The research was then divided into two phases. In phase one, the researcher investigated the general background of the schools and teachers, their policies in implementing PGS and teachers' beliefs in PGS. The procedures in phase one include:

1. Informal discussion with the school principals
2. Initial interviews deliver to all PGS teachers of the two target schools.
3. Analyzing relevant documents provided by the schools
4. Analyzing students' PGS home works and assignments

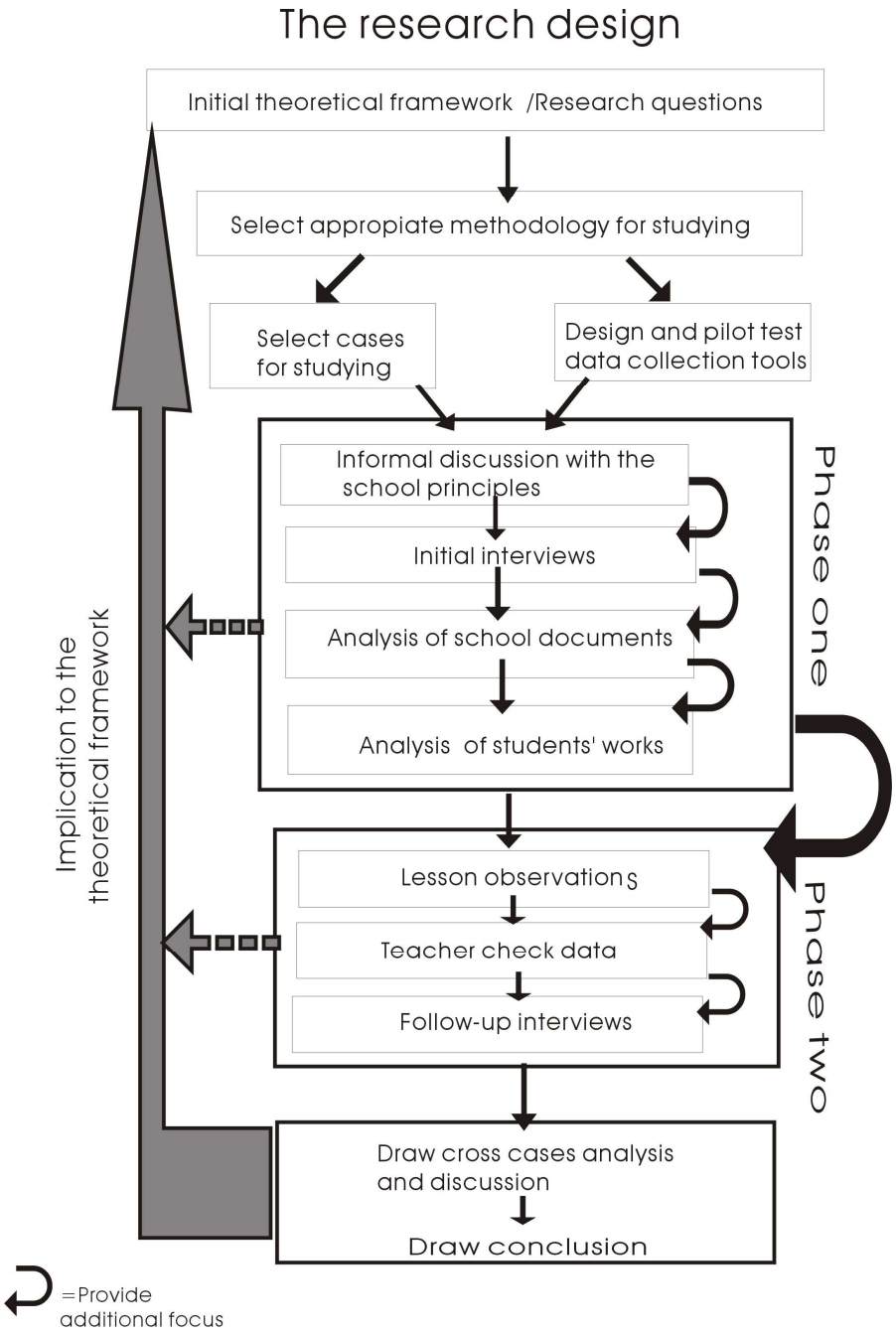
The results generated from each step will provide more information and focuses for next steps. Then, the results found at phase one were compared and contrasted to the findings obtained from that of the second phase. Finally, the conclusions to the research questions will be drawn by referencing to the findings from both the first and second phases of this study. In fact, in the second phase of the study, specific targets will be observed and interviewed so as to focus on the specific target areas and research questions. The major actions in the second phase include:

1. Observing the lessons for the teachers selected from initial interviews.
2. Taking observation data and tentative interpretations back to the teachers being observed and have them check the materials before the follow-up interviews.
3. Delivering follow-up interviews to observed teachers.

Throughout the procedures from phase one to phase two of the study, the

researcher has kept his own journal and notes for recording the observation, impression and thought happen during the study.

Figure (3.1) the research design



Such a design has taken the principles of two types of qualitative research theories. First, the Constant Comparative Approach (Glaser and

Strauss, 1967), in which data obtained at different levels and phases are compared and contrasted until certain conclusions could be reached (Merriam,1998). Second, the multiple data collection and analytic procedure of Case Study methodology as suggested by Freebody (2003) in which the researcher should

1. *compare and contrast interpretations;*
2. *expand on the relevance of the project by developing unforeseen findings and interpretations; and*
3. *explore findings that are anomalous to or disconfirming of original hypotheses and impressions. (p. 83)*

As discussed earlier (see section 2.3) for the target focus to look at, the hypothesized components of the belief-action process of Sigel (1985) and the relevant interpretations of O' Loughlin (1989) have been referenced. Hence, various tools are used to collect data reflecting the hypothesized components as illustrated in table (3.1).

Table (3.1) Collection of data and the hypothesized components of Sigel

Tools	Target/ Data collected	Sigel's components
Informal conversation with school principles	Two principals ● School background ● Teachers background ● School policies	-Sources of belief -Agent inducing change in belief
Initial interview With all PGS teachers	All PGS teachers (5 from school A, 3 from school B) ● Teachers' beliefs about inquiry-based learning ● Teacher's background ● Practices of the PGS lessons	-Sources of belief -Agent inducing change in belief -Core belief -Belief about praxis -Contextual influence -Outcome of theories

		in action
Analysis of school documents	Teachers' handbook of school(A) PGS panel meeting minutes of school B ● School policies on the new PGS curriculum ● Resources, training and backup for the new PGS curriculum ● Teachers' preparation work for the PGS lessons	-Agent inducing change in belief -Contextual influence
Analysis of students PGS works	Workbooks, project report books worksheets ● Design of the assignment ● Method of marking and assessing ● Teachers' feedback ● Students' performance	-Belief about praxis -Outcome of theories in action
Lesson observation	Two teachers from school(A) another two from school (B), and their students ● The performance of teachers and students at the PGS lessons, especially in the view of inquiry-based learning	-Belief about praxis -Outcome of theories in action
Teachers check observational data and follow-up interview	The four observed teachers ● check data recorded in observed lessons ● comment the interpretation of the researcher about the observed lessons ● teachers' interpretation of their own teaching behaviour and students responds	-Sources of belief -Core belief -Belief about praxis -Theory-in-action -Contextual influence -Outcome of theories in action

In fact, Sigel' seven hypothesized components and O'Loughlin's interpretation are employed and translated into following investigation areas in the context of present study as shown in table (3.2).

Table (3.2) The interpretation of Sigel's components of belief

Sigel	O' Loughlin	Present study
The sources of beliefs	The issue of the origin of teachers' beliefs; life experience, family background etc.	The investigation of the target teachers' bibliographical information
The agents that induce change in beliefs	The teacher preparation programme teacher received, the practical socialization teacher received in schools during observation, internship and actual teaching.	The investigation of the school background, the training and policies about inquiry-based learning the target teachers received
The core belief	Teachers' knowledge of and perception of their discipline; e.g. nature of knowledge, pedagogical and child development theories	The study of teachers' belief in the basic principles about teaching and learning, and the basic principles about inquiry-based learning adopted by the authority
The belief-praxis	The belief teachers hold about the practice of teaching	The study of teachers' belief about how to lead inquiry-based learning in classroom
The theory-in-action	The implicit rationale of specific teaching behaviour	The searching of teachers' rationales for their teaching behaviour in the inquiry-based lessons being observed.

The contextual influence on belief formation	The belief system reflected in the educational environment of the school: explicit and hidden curriculum, standardized tests, pre-packaged curricular and mass-produced worksheets	The examination of the background of the target schools, their policies and cultures and see how such contextual factors affect teachers' belief and action.
The outcomes of the theories-in -action	The observed effects on student development, learning and performance of the specific style of practice adopted by the teacher	The study of students' works and performance in the inquiry-based lessons.

3.2.1 Design of data collecting tools

In the aspect of data collection, it is the common practice to adopt a multiple methods approach to data collection in a qualitative case study research (Stake 2000; Yin, 1994). Brewer and Hunter (1989) also recommend the complementary strengths of multiple methods to answer a research question. Hamel, Dufour & Fortin (1993) listed three common means of data collecting in case study, they are interviews, observation and field studies. As mentioned earlier O' Loughin (1989) suggested that in detecting the hypothesized components of the belief-action process of Sigel (1985) a combination of observation and interview techniques is recommended. Apart from taking up these suggestions, the data collection tools and procedure in this study have been designed with the following strategies:

Initial interview questions (see appendix 1): The purpose of the initial

interview is to obtain the general background of the teachers and their general belief about the new PGS and inquiry-based learning. The initial interviews were delivered to all PGS teachers in the cases (there are 5 teachers in school A and 3 in school B). The interview questions were structured with some fixed questions. By delivering the initial interview, on the one hand, the researcher compare and contrast teachers' beliefs in inquiry-based learning, by having teachers commenting on the same quotation extracted from the official curriculum document and expressing their opinion. On the other hand, the researcher had to investigate the sources of teachers' beliefs towards inquiry-based learning.

Checklist for analyzing school documents (see appendix 2): After the initial interviews, relevant documents from the target schools were analyzed to see the official viewpoints, plans and policies of school administrations and subject panel members towards the new PGS. The basic checklist for documentary analysis was designed according to the recommendation of Exline (1995). At the preparation stage of inquiry approach, Exline (1995) defined a list of teachers' proper behaviours in preparing and leading an inquiry lesson. In Exline's "*stage of lesson planning*", teachers should demonstrate that they

- plan ways for encouraging learners to engage in the learning process,
- plan ways to encourage learners to take increasing responsibility for their learning,
- insure that classroom learning is focused on relevant and applicable outcomes,
- prepare the classroom environment with the necessary learning tools,

materials, and resources for active involvement of the learner,

- set content learning in a conceptual framework, stress skill development and nurture the development of habits of mind, and
- make student assessment an ongoing part of the facilitation of the learning process.

Exline also generalized the following behaviour pattern of teachers who taught with inquiry-based approach:

- He encourages divergent thinking that leads to more questions.
- He values and encourages responses and, he clarifies misconception.
- He is constantly alert to learning obstacles and guides learners when necessary.
- He asks "Why?" "How do you know?" and "What is the evidence?"

The checklist was piloted and it was supplemented with questions emerged from analysing the result of the initial interviews.

Checklist for analysing students' PGS work (see appendix 3): Students' works was then analysed according to designed rubrics that were featured with characteristics of the output of inquiry-based learning proposed by Grotzer (1996). In studying the outputs of inquiry-based learning and teaching in lessons, Grotzer (1996) generated following features:

- Children construct understanding and knowledge through experiential learning and their own questions but the process is mediated by adults.
- Question-asking is invited.
- Mistakes are valued for the learning they provide and as natural parts of inquiry process.
- Open ended questions are asked and appreciated.

- There is more than one possible answer.
- Theorizing and considering evidence is considered more important than a "right answer".
- Sometimes questions are asked and not answered.
- All ideas are welcome to share.
- Ideas are discussed for their explanatory potential, ability to solve the problem, and the thinking that they inspire as opposed to being called "good" or "bad", "right" or "wrong".

Similarly, the rubrics were also amended after taking reference of the results of the initial interviews and documentary analysis.

Checklist for lesson observation (see appendix 4): After the preliminary phase (initial interview, documentary analysis and students' work analysis), the researcher then observed the PGS lessons for selected teachers who showed supportive beliefs towards inquiry-based learning and the ones who showed negative beliefs. The observations were administrated with a basic checklist that was pre-designed with the suggestions by Falk, & Drayton, (2001) for a successful inquiry-based lesson as they suggested the following characteristics for successful inquiry-based lessons. These characteristics include:

- Inquiry is in the form of authentic problems within the context of the curriculum and/or community.
- The inquiry capitalizes on student curiosity.
- Data and information are actively used, interpreted, refined, digested and discussed.
- Teachers, students collaborate.

- Community and society are connected with the inquiry.
- The teacher models the behaviour of inquirer.
- The teacher uses the language of inquiry on an ongoing basis.
- Students take ownership of their learning.
- The teacher facilitates the process of gathering and presenting information.
- The teacher and students use technology to advance inquiry.
- The teacher embraces inquiry as both content and pedagogy.
- The teacher and students interact more frequently and more actively than during traditional teaching.
- There is an identifiable time for inquiry-based learning.

In addition, the characteristics of effective teaching behaviour for teachers facilitating inquiry-based learning recommended by Exline (1995) are also referenced. Certainly, additional focuses were added after the analysis of the result obtained from phase one of the studies.

Questions for follow-up interviews: Afterward, follow-up interviews were conducted to the observed teachers for them to explain their rationales of their performance. The follow-up in-depth interview was not structured. The questions were set for clarifying what teachers did in the lessons and ample room was reserved for them to articulate their feeling and thinking. The follow-up interviews were benefited from a procedure that the observation data were taken back to the observed teachers before they attend the follow-up interviews. Therefore, the observed teachers could comment and clarify the judgements and records of the researcher during the follow-up interviews.

Although the clues for inquiry-based learning disclosed in above references were built upon various definitions of inquiry-based learning, these characteristics go with the two basic principles in defining inquiry-based learning by the Hong Kong CDC for the new PGS, they are "i*nquiry is not much about seeking the right answer"* (e.g. more than one possible answer are accepted raised by Grotzer,1996) and "*teachers as facilitators*" (e.g. the teacher facilitates the process of gathering and presenting information suggested by Falk, & Drayton, 2001). As mentioned, such principles also constructing the definition of inquiry-based learning adopted in the present study.

These common characteristics are also in conformity with the theoretical framework that studying the contextual factors of individual school being crucial in understanding the challenges of inquiry-based learning for teachers and the constraints affecting teachers in act according to their beliefs (e.g. prepare the classroom environment with the necessary learning resources for active involvement of the learner suggested by Exline 1995). Thus, these features constructed useful reference for designing tools to detect the appearance or manifestation of inquiry-based learning in specific classroom. Therefore the researcher has chosen these features as reference for designing tools to collected data in this study.

3.3 Piloting of tools

Before the research commenced, the researcher had to make sure each tool for data collection could effectively collect the data it purported to collect. Hence, there was a piloting process for each of the data collecting tool. First of all the drafts of the questions for initial interviews were

presented to teachers with similar background. Three PGS teachers from other schools were invited to answer the questions and commented on it afterward. These three teachers also inspected the basic checklists for analysis of documents and students' works. After the procedure of phase one had been carried out, the researcher designed the checklist for lesson observation and two other PGS teachers outside the target schools examined this checklist. The contribution of the piloting process included the following aspects:

1. Wording of the interview questions have been amended to make them more accurate and direct.
2. The number of questions for the initial interview had been reduced from 28 to 21, as the pilot respondents commented that too many questions annoyed the respondents and thus make them answer it in a less serious manner.
3. The observation checklist was amended to contain some broad areas instead of lists of specific questions. According to pilot teacher's opinion, the researcher should allow more room for uniqueness of individual school.

Since the follow-up interview planned as follow-up actions for the lesson observations and therefore, they are unstructured in format in order that they could allow enough room for the respondent to explain their own behaviour, and therefore there was not a piloting test for the questions used in the follow-up interview.

3.4 Analysis of data

Basit (2003) explained that unlike some quantitative research,

qualitative research usually lacks a division of labour between data collectors and analysts. He added, throughout analysis, researchers attempt to gain a deeper understanding of what they have studied and to continually refine their interpretations. It is also the practice in this research that data were collected and analyzed by the same person. Thus new questions and ideas generated along with the data collecting will soon alert the researcher and it constituted an important component for further data collection and the analysis process. During the process of data collecting and analysis, the researcher also took the advice of Taylor and Bogdan (1998) to draw on the firsthand experience with settings, informants or documents to interpret the data collected

On the other hand, the researcher followed the steps prescribed by Neuman (1997) in data collection.

- Rereading data notes;
- Mentally repackaging details into organizing ideas;
- Constructing new ideas from notes on subjective meanings or from the researcher's ideas;
- Looking for relationships among ideas and putting them into sets on the basis of logical similarity;
- Organizing them into larger groups by comparing and contrasting the sets of ideas; and
- Reorganizing and linking the groups together with broader integrating themes.

As a whole picture, the findings were analysed practically in the following sequence:

1. The background information drawn from the initial interviews was used

for establishing the basic context of the research.

2. The findings from initial interviews about teachers' beliefs in inquiry-based learning were compared to and contrasted with the theoretical framework.
3. The findings from analysis of schools' documents and students' works were also important elements of the research context. They were compared and contrasted to the findings from initial interviews of teachers' beliefs, and analyzed with literature reference on teachers' beliefs and inquiry-based learning. The results were also contrasted to the theoretical framework.
4. The questions emerged from initial interviews, document analysis and the analysis of students' work were added to the checklist of lesson observations.
5. The observed classroom situations were further juxtaposed with the follow-up interviews and then they were also compared to the claimed beliefs of teachers manifested in the initial interviews.
6. The whole picture of the school's implementation of the PGS (constructed by the findings of schools documents, student' works, classroom observations, and interviews) was then evaluated with the findings of PGS teachers' beliefs and interpretation of inquiry-based learning of the target schools.
7. Similar procedures were applied on the two selected schools and then the findings were compared and contrasted.

On the other hand, in constructing data interpretation structure, following aspects are considered.

1. The theoretical framework and its supplements made after considering

the data found in different stages and from different tools.

2. The sub questions of the research question.

3.5 The Constant Comparative Method

The constant comparative method of data analysis developed by Glaser and Strauss (1967) has been chosen as the major reference for the constant comparing and contrasting of data from the following areas:

1. Data obtained from different tools; interviews, observation, documentary and student's works analysis.
2. Opinions drawn from interviewing teachers versus the information obtained from lesson observations.
3. Data collected in the two different schools selected for case studies.

Such comparisons lead to tentative categories that are then compared to each other. According to Merriam (1998)

> *The comparisons are constantly made within and between levels of conceptualization until a theory can be formulated.* (p.159)

Hence, the data obtained from different stages and tools were compared constantly between tentative conceptualization until a conclusion or even theory can be formed.

3.6 Validity and Reliability

Although researchers of qualitative research challenge the traditional concepts of validity and reliability (Lincoln and Guba 1985; Firestone, 1987; Patton, 1990 and Wolcott, 1994), the following actions were selected to enhance these widely known qualities of the research.

3.6.1 Internal validity

To maintain and enhance the internal validity, the triangulation function was identified as follows:

1. Data triangulation: A variety of data sources has been identified. They included documents and records of schools, students' works, the responds and comments from teachers in the initial interviews and follow-up interviews and the observational data obtained from the classroom observations.
2. Theories triangulation: The study has adopted multiple perspectives to interpret a single set of data, including the contemporary theories arguing inquiry-based learning and teachers' beliefs as concluded in the theoretical framework.
3. Methodological triangulation: The study used multiple methods to study a single problem including interview, observation, document analysis, students' work analysis, lesson observations and follow-up interview.
4. Member check: this study has also taken the suggestion of Merriam (1998) that qualitative researchers can take the data and tentative interpretation back to the people from whom the data were derived, so as to enhance the internal validity of the study. Hence, the observation data and tentative interpretation are taken back to relevant teachers before the follow-up interviews. By doing that teachers comment the data when they further explain their behaviour at the observed lessons.

3.6.2 External validity

Stake (1995) remarked, to offset the localization and apparent subjectively of a qualitative study, various kinds of triangulation have to be

employed. In order to promote the "fittingness" concept so as to replace the traditional criteria for "generalization" or external validity (Guba and Lincoln, 1982), emphasis has been put on supplying a substantial amount of information about the entity studied and the setting in which that entity was found. The collected data was also interpreted with reference to the literature and related arguments. Besides rich and thick description of the case being studied, "multi site designs" (Merriam 1998) concept has also been adopted in which cases with maximize diversity in the phenomenon of interest have been chosen. That explains the reason for choosing one traditional school and one school with relative open culture as case samples.

3.6.3 Reliability

Lincoln and Guba (1985) recommend qualitative researchers to use the concept of "dependability" of the results obtained from the data, instead of using the traditional reliability notion. In this study, following measures have been included to ensure that results are dependable:

1. The researcher explained the assumptions and theories behind the study and the social context from which data were collected (Lecompte and Preissle, 1993)
2. The researcher adopted triangulation in methods.
3. The researcher explained how data were collected, and how decisions were made throughout the inquiry (Dey, 1993).

3.7 Ethical consideration

The major difficulty in this study was the seeking of approval from the target schools. The permission to do an in depth study in local primary

schools was not easy, especially in nowadays, as schools and teachers are exhausted with routine and extra work loaded added by the curriculum reform. Nevertheless, as the new inquiry curriculum being implemented in recent years, teachers engaging in the new Primary General Studies teaching are expecting academic investigation into their works as a reflection and support to their professional knowledge. The researcher has adopted following procedures to ensure the ethical standard of this study.

1. Approvals have been obtained from target schools before the research commenced.
2. All participants were informed and explained about the purpose of this study. A letter from the School of Education of Durham University, indicating the legitimacy for this research, was presented before all participants and the school principals of the target schools.
3. All participants in the research have been guaranteed privacy, anonymity and confidentiality.
4. School names and other recognizable remarks were concealed.

Chapter 4

Background of the target schools

4.1 The school A

As it has been explained in the methodology chapter, the choice of the target schools was made according to the uniqueness of the schools. In this study, school (A) and (B) were two distinctive cases among local schools. According to the school web site and the information provided by the principal in the informal meeting, some background information about school (A) was discovered:

1. It is a government subsidized primary school organized by a Christian church and in fact part of the school building is the chapel of the church (see picture 4.1). There are 12 classes in the school. According to the principal, it is the limitation of the school building that restricts them from recruiting more students. In fact, many applicants are disappointed each year.
2. The school is situated in the urban area of Hong Kong. The school building is surrounded by middle class residential buildings.
3. The school has over 40 years of history. The school building is relatively small and below normal standard. There is no school hall and the chapel is always used as a place for students' assembly (see picture 4.2). Although the school possesses certain equipment and facilities, the number of special rooms is fewer compared to ordinary schools.
4. There are 40 teachers in this school, 28 of them are female. The average age of the teachers is around 38. As the school document indicates,

most of their teachers are experienced.

5. There are 5 teachers teaching PGS in this school. They are 2 males and 3 females.

School (A) is deemed a traditional primary school because of following evidence:

1. The church clergyman is appointed as the school supervisor and the members in the board of school management are mainly the members of the church.
2. According to the school profile posted on the school web site, the school emphasis is very much on academic standards and students' discipline. As it is reported in school document, *"students are well disciplined and standard of academic is high"* (School Development Plans, 2005-2007, p.3).
3. In the aspect of school-based curriculum development (disclosed by the school principal and the school web site), the school focuses mainly on language studies (Chinese and English) and mathematics. In fact, the number of PGS lesson has been cut in order to add more lessons for subjects of Chinese and English language. External resources have also been invited to help enhance students' performance in English, Chinese and mathematics.
4. The school claimed that the mission of the school is to foster useful talents for the society in the foundation of Christian faiths (School Development Plans, 2005-2008, p.2). It reminds people of the rationale of "traditional education" in the history of curriculum research field (Pinar, 2004).
5. Effort in helping the personal development of children is rare. Most of

the school plans are aiming at enhancing academic standard of children, especially in the three major subjects; Chinese language, English language and mathematics.

In addition to the above evidences, during the preliminary discussion, the principal told the researcher that the school is famous for its discipline, moral education and academic standard. The school perceived that parents like to put their children in schools with good discipline. In fact, the school is classified as a band one school (means the top band) in the district. In the aspect of the new PGS curriculum, the principal briefly described the school policy that they would follow the direction of the official curriculum. The direction of inquiry-based learning has been documented in their school handbook and he believed that his teachers are following such direction.

Picture (4.1) Part of the school (A) building is the chapel of the church

4.2 The school B

As a comparison, school (B) has different background. According to the school web site and the information provided by the principal at the first meeting, some basic information about school (B) are as follow:

1. It is also a government-subsidized primary school with only 8 classes. In fact, the school is experiencing a deduction of classes, a policy of the government for tackling the decrease of student population in Hong Kong. The school used to have 24 classes but now only 8 classes left. The school is run by an organization that promotes the rights of women and children.
2. The school is situated on a public housing estate in the new town area (see picture 4.3). Students mainly come from working class families.
3. The school has about 20 years of history. The school building is a standard one according to 1980s official standard. There are special rooms for art, music and computer subjects but there is not one for the PGS subject.
4. There are 29 teachers and 10 of them are male, 19 are female. Most of the teachers are relatively young. According to the information provided by the principal, the average age of teachers is around 30.
5. There are 3 teachers in the PGS subject panel, 2 male and 1 female.

School (B) is deemed as a progressive primary school because of following evidence:

1. The organizing body of the school is famous for promoting the rights of women and the care of children. As the mission statement of the school stated, they aim at promoting the right for personal development and formal education. The school also stated clearly on the web site that

they emphasize the needs of the children in social, psychological and intellectual aspects. Such rationales reminded us of the advocacy of the people who were labelled as "progressive educationalist" in the history of curriculum research field (Pinar, 2004).

2. According to the school web site, the school has set out objectives and plans to enhance the self-learning ability and other generic skills of students. It is also a policy for the school to design tasks-based and experiential learning for their students. These strategies are features of the child-centre concept of Dewey.
3. The extra-curricular activities in this school are well balanced with academic, services and recreation. There are more activities in this school as comparing to school (A), especially those for cultivating children' personal interest and talents.

The principal of school (B) developed in his school the reputation of vigour and extra-curricular activities. Although the school is only classified as a band two school (the lowest one is band three), he was proud of his own school for other achievements, he showed the researcher the news cuttings about his students winning prizes in some competitions of sports and music. In the aspect of the new PGS curriculum, the principal explained that the teachers in the PGS panel are professional and they already put effort in implementing inquiry-based learning in lessons and he recommend me to ask the panel chairman for detail.

Considering the uniqueness of the cases selected, school (A) is a traditional one, it has more teachers and students and it is older. It also pays more attention to academic studies and discipline. School (B) is relatively younger, both in terms of school building and teachers' ages. It has a fewer

number of teachers and students and it focuses more on students' balanced development. Since inquiry-based learning is a child-centered approach, various focuses on educating children should create different stories in implementing such a child-centered curriculum.

Picture (4.2) the school building of school (B) (school name concealed)
The school building is surrounded by public housing estates, a typical working class community.

Chapter 5

Phase One of the study: Report of the initial interview

5.1 Purpose of the initial interview

As the beginning of the study, the first step was to obtain the background information and general beliefs of the PGS teachers in the two target schools, especially concerning inquiry-based learning. From that, basic information and impressions were analysed preliminarily to generate new ideas and focus points (Neuman, 1997) for the data collection procedures following. Specific targets (Patton, 1990) were also identified for further investigation. Therefore, the first phase of the study was designed as conducting initial interviews for all the PGS teachers of the targeted schools, analysing the relevant school documents and inspecting students' works. The findings were also used to justify or amend the argument in the initial theoretical framework. The following paragraphs describe the findings of the initial interviews. The information gathered at this stage was also used to establish the context for analysing teachers' behaviour in lessons.

5.2 Description of the interview environment

The initial interviews were arranged with the co-operation of the school administrations. The principal of schoo1 (A) arranged for the researcher to interview his PGS teachers at the school library. It was a room with area about 50m times 60m. There was a round table and some chairs surrounded it. Privacy was ensured because no one was allowed to enter the site during the interviews. The interviews started at nine o'clock in the morning and lasted until twelve o'clock. Each of the 5 teachers was interviewed for

approximately 30 to 45minutes.

The principal of school (B) arranged for the researcher to interview the PGS teachers in the staff common room. The situation was quite different there, because other teachers were allowed to use the room while the interviews were in progress. Actually, there was some interference during the interviews due to the telephone calls from outside. The interviews started at ten o'clock in the morning and ended by twelve o'clock. Each of the 3 teachers was interviewed for about 30 to 45minutes.

5.3 Background of the interviewed teachers

All PGS teachers of school (A) and (B) were interviewed. There were 8 teachers being interviewed, 5 of them from school (A) and 3 of them from school (B). The backgrounds of the teachers from school (A) are as follows (names are only codes representing the teachers).

Henry is a male teacher of 25 to 30 years old with about 7 years of teaching experience. He has been teaching PGS for 7 years. He is the panel chairperson of the PGS subject at school (A).

Sally is a female teacher of 35 to 40 years old with about 10 years of teaching experience. She has been teaching PGS for 8 years.

May is a female teacher of 30-35 years old with about 7 years of teaching experience. She has 6 years of experience in teaching PGS.

David is a male teacher of 40-45 years old with about 15 years of teaching experience. He has 10 years of experience in teaching PGS.

Fanny is a female teacher of 35 to 40 years old with about 10 years of teaching experience. She has 7 years of experience in teaching PGS

The backgrounds of teachers from school (B) are as follows (names are

only codes representing the teachers).

Alex is a male teacher between 30 to 35 years old with about 9 years of teaching experience. He is the panel chairperson of the PGS subject at school (B). He has been teaching PGS for 5years.

Judy is a female teacher between 25-30 years old with about 5 years of teaching experience and she has been teaching PGS for 5 years.

Peter is a male teacher about 45 to 50 years old. He has 20 years of teaching experience. He has been teaching PGS for over 10 years.

5.4 Interview questions and the results

There were 21 interview questions in total (see appendix 1). The function of each question and the results obtained are as follows.

1. Questions for collecting biographical information

Since there was some consideration for the teachers' feeling in protecting privacy, some questions about bibliographical information were put at the back of the interview as question 18, 19, 20 and 21.

Q1. Which level of Primary General Studies (PGS) do you teach?
Q2. How many classes of PGS do you teach?

Questions (1) and (2) were lead-in questions and they helped with warming up the conversation between the researcher and the respondents. The two questions were only asking for very superficial information of the respondents and it was planned that detail bibliographical information would not be asked for at this moment but at the end of the interview. The results of these two questions show that in school (A), Henry and Fanny both teach two classes and two different levels of students. Fanny has to teach both senior and junior levels. Other teachers in school (A)

only teach one level. The situation of school (B) is relative simple; each teacher teaches two classes of the same level except Alex, he has to teach four classes. The actual results are shown in table (5.1).

Table (5.1) The results of questions (1) and (2) of the initial interview

N=8

Teacher (school)	Level taught (p=primary)	No. of classes taught
Henry (A)	P5(11 years old) and P4 (10years old)	4 classes
Sally (A)	P1 (6 years old)	2 classes
May (A)	P3 (9 years old)	1class
David (A)	P3 (9 years old)	1 class
Fanny (A)	P2 (7 years old) and P6 (12 years old)	4 classes
Alex (B)	P5 (11 years old) and P6 (12 years old)	4 classes
Judy (B)	P3 (9 years old) and P4 (10years old)	2 classes
Peter (B)	P1(6 years old) and P2 (7 years old)	2 classes

Q18. Have you received any pre-services training in teaching PGS? Where?

Q19. Have you taken any in-services training in teaching PGS? Where? When?

Q20. Which major subject did you take at University or college of education?

Q21. Which subject stream did you take in secondary education?

Science stream? Humanities stream? Commerce and business stream?

The four questions, questions (18) to (21) required the respondents to provide information on their academic and professional background, especially concerning the training in teaching PGS. The results are expressed in table (5.2).

Table (5.2) The result of questions (18), (19), (20), (21)

N=8

Teacher (school)	Pre-services teacher training	In-services training (PGS)	Major subjects (University/ College)	Subjects stream (secondary school)
Henry (A)	HKIED	HKIED 02-03	Chemistry	science
Sally (A)	HKIED	HKIED 02-03	Chinese history	humanities
May (A)	HKIED	HKIED 03-04	History	humanities
David (A)	HKIED	HKIED 03-04	English	humanities
Fanny (A)	HKIED	HKIED 02-03	Chinese	humanities
Alex [2] (B)	HKIED	HKIED02-03	PGS	science
Judy(B)	HKIED	HKIED04-05	Maths	science

[2] Alex is the only one who has obtained his degree from the Hong Kong Institute of Education. Therefore, his major subject is Primary General Studies. Other teachers have their university degrees plus pre services training (mostly part time) certificates from the Hong Kong Institute of Education.

Peter (B)	HKIED	HKIED04-05	Geography	humanities

By analysing the results of questions (1), (2), (18), (19) (20) and (21), academic and personal background of the interviewed teachers are disclosed. The PGS teachers in both schools are qualified and experienced teachers. All teachers have received their pre-services teacher training and all teachers have finished their in-services training for teaching PGS. All 5 respondents of school (A) have over 6 years of experience in teaching PGS while all 3 teachers from school (B) have been teaching PGS for at least 4 years. It has also been disclosed in the interviews that almost all teachers were educated with Humanities or Arts subjects at universities or at the [3]HKIED except Henry and Judy.

Referring to the sources of belief and core belief of Sigel (1985), the training and education of the PGS teachers may have influenced them in viewing the role of teachers, role of students and the nature of the PGS. Since all teachers under study have received their in-services training for teaching the new PGS (2004 version), they should understand the inquiry nature of this new curriculum. However, teachers also disclosed that the in-services training courses were several-hours-introduction to the new curriculum only. In other words, as an important "agent inducing the change in belief" (Sigel 1985) in the inquiry-based PGS, the in-services training programme may not have strong influence in teachers' belief formation about inquiry-based learning. However, Alex of school (B) received his pre-services training in teaching PGS, and Henry of school

[3] The Hong Kong Institute of Education is the only official organization which provides pre-services training for local primary teachers.

(A) had chemistry as major subject in university. Hence, it seems that the influence of such training in the belief formation of Alex and Henry about inquiry-based leaning may be greater. Looking at the secondary and tertiary education background, those educated with science discipline (Henry, Alex and Judy) may have better chance to experience inquiry-based learning activities. It is because science inquiry has been a trend in science education for decades (Anderson, 1998).

2. Questions for assessing the understanding of the new PGS

Q3. Have you ever taught the old PGS syllabus (the one before 2004)?

Q4. In your opinion, what is the biggest difference between the new PGS and the old one?

Q5. Have you noticed the term "inquiry-based learning" in the Guideline of the new PGS ?

Questions (3) to (5) recall teachers' memory about the difference between the old PGS curriculum and the new one. It was hoped that teachers would bring out the concept of inquiry-based learning because it is the major feature of the new PGS curriculum. The result is illustrated in table (5.3).

Table (5.3) The result of question (3), (4), (5)

N=8

Teacher (school)	Taught old PGS?	Biggest difference? (old /new PGS)	Notice inquiry-based Learning?
Henry (A)	yes	-new strands of content -new approach	yes (sure)
Sally (A)	yes	-2 new strands of content -inquiry-based learning	yes (sure)
May(A)	yes	-new content on	yes (not so sure)

		"national identity"	
David (A)	yes	-science experimental learning	yes (sure)
Fanny (A)	yes	-more or less the same	yes (not so sure)
Alex (B)	yes	-2 new strands of content -inquiry-based approach	yes (sure)
Judy (B)	yes	-new strands of learning areas -inquiry-based approach	yes (sure)
Peter (B)	yes	-new content and -inquiry-based approach	yes (sure)

The results show that all teachers has taught the old version PGS. In school (A), Henry showed better understanding than others did when telling the difference between the new and old version PGS. Fanny showed little understanding about the new PGS. Similarly, Alex showed better understanding about the new PGS comparing to other school (B) teachers. Besides, teachers from school (B) are relatively better aware of the change of the new curriculum, especially about the adoption of the inquiry-based approach in the new PGS. All teachers of school (B) mentioned inquiry-based approach as the new element of the new PGS while only one teacher from school (A) mentioned exactly the term "inquiry" or "inquiry-based learning".

Referring to the "agent inducing the change in belief" of Sigel (1985), all teachers are aware that there was a change in the PGS

curriculum but only some of them noticed the change in pedagogy. It implies that the information about the new PGS may be different inside the two target schools. Teachers in school (B) seems to be better informed about the change in the new PGS, it may also imply that the school administration or the subject head of school (B) is a relatively effective agent for inducing the change in belief about inquiry-based learning.

3. Questions for understanding teacher's interpretation of inquiry-based learning

Q6. How do you interpret following statements about inquiry-based learning as quoted from the new PGS Guideline?

(A) *In the inquiry process, students are active constructors of knowledge and the teacher is a facilitator of learning.*

(B) *Inquiry is not so much seeking the right answer ─ because sometimes there is none ─ but rather, seeking appropriate solutions to problems.*

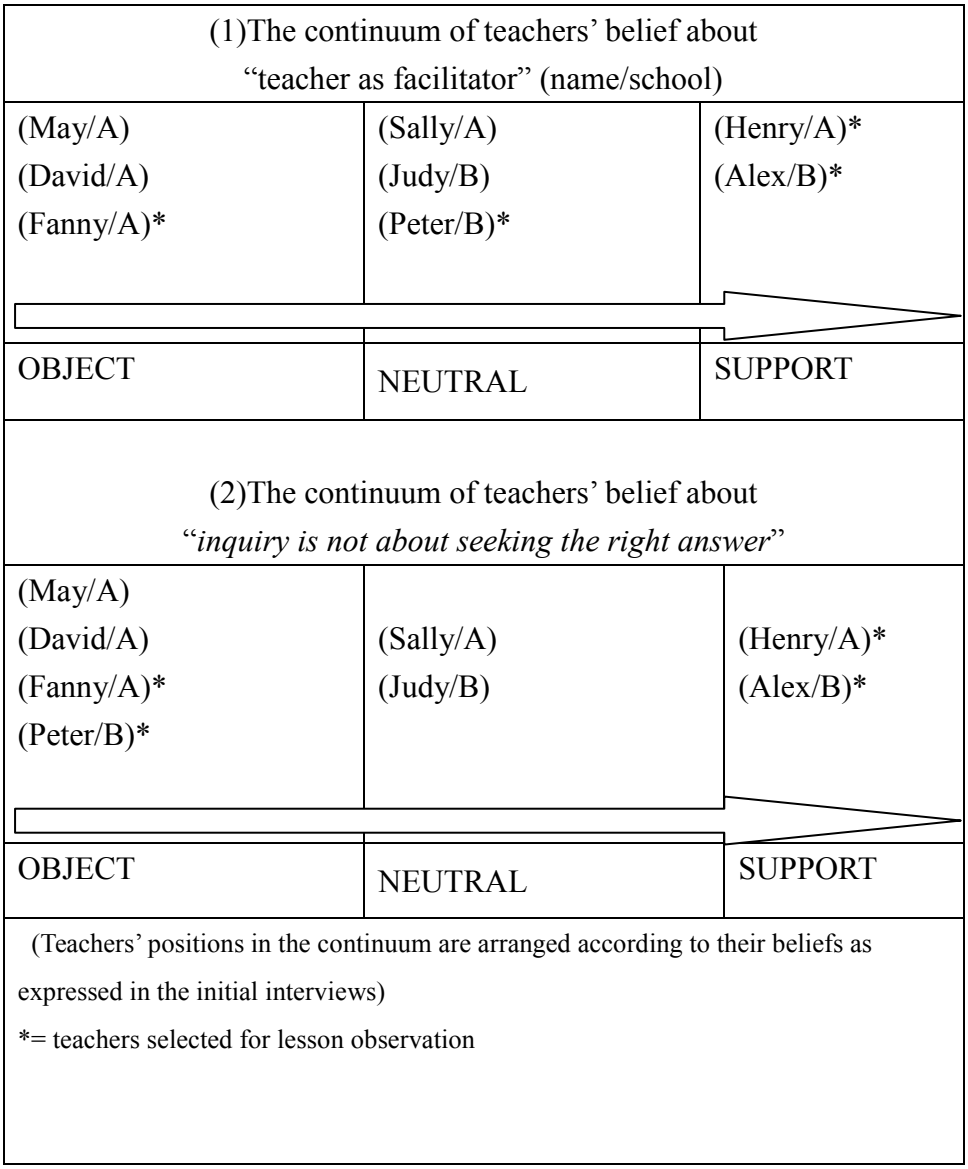
(CDC, 2001, p.80)

Q7. In your opinion, what kind of teaching strategies should a teacher use in order to implement the inquiry-based learning principle in PGS?

Q8. In your opinion, how should the student learn or behave in an inquiry-based PGS lesson?

Question (6) asked teachers to interpret the quotations extracted from the official PGS Guide of inquiry-based learning. The quotations were chosen as standards for comparing opinions of different respondents towards the basic principles of inquiry-based learning. Questions (7) and (8) helped the respondents to articulate further their beliefs in inquiry-based learning. The results are expressed in following figure.

Figure (5.1) The result of question (6) of the initial interview



The researcher grouped the answers of the respondents by using three categories; they are "object", "neutral" and "support", according to their answers and attitude expressed in the interviews about the two quotations. In the first continuum, those teachers being grouped around the left hand side of the first continuum (the object side) tend to object the idea "*teachers should be facilitators in learning*". Fanny of school (A) expressed strongest and clearest ground that she did not support the idea that in inquiry-based learning teachers are facilitators of students'

learning, because she thought that it is the inborn duty of teachers to transmit knowledge to students. May of school (A) showed similar viewpoint but she used less firm language. They both said that it should not happen in primary level that teachers only act as facilitators in the learning process. David of school (A) also showed disagreement on this quotation but he expressed it in soft language. He provided answers like *"I think it is not very suitable to define teacher's job in this way…."*

Sally of school (A), Judy of school (B) and Peter of school (B) were positioned in the middle of the continuum (the neutral side). They held reservation to the first quotation. For instance, Judy said, "*I don't completely disagree on this statement, but sometimes teachers should not talk too much!*" Sally said, *"I am not sure whether it is correct or not, but I know it is the new way of teaching and learning.*" Peter said, "*It is difficult to do so and yet I think that it is the new trend in education*".

On the other side of the first continuum (the support side), Henry of school (A) and Alex of school (B) both expressed the clear support to the quotation. They listed following reasons for supporting attitude. Such reasons included the preparation of children for the new era (mentioned by Henry), the need for fostering independent learning (mentioned by Alex) and the personal experience in acting as facilitators instead of knowledge transmitters (mentioned by both Henry and Alex).

For the second continuum, the positioning of the teachers shows the following differences: Fanny, May, David of school (A) and Peter of school (B) showed strong and clear standpoints in rejecting the principle of "*inquiry is not about seeking the right answer"*. They insisted that even in inquiry-based learning, the ultimate goal is to help students to

seek the right answer. Again, Fanny held the strongest negative attitude towards the statement. However, Peter of school (B) joined the team of objection for commenting this quotation, as he said that he could not accept such a view for learning, it is too risky.

Only Sally of school (A) and Judy of school (B) were left in the neutral section, as they still showed no clear ground when commenting the second quotation.

Henry of school (A) and Alex of school (B) insisted on their standpoints in both quotations one and two. They are situated at the support side for both quotations.

Concluding the analysis of the responds to the two quotations, teachers of school (B) tend to situate closer to the right hand side of the continuum that is the neutral and support sides. In other words, they hold relative positive belief towards the basic principles of inquiry-based learning. However, analyzing the two principles that representing the inquiry theory the authority selected, the first one “teachers as facilitator” obtains more positive responds, while the second one “inquiry is not much about seeking the right answers” obtains less support. When analyzing with Sigel’s (1985) components of belief, the core belief of the teachers about the roles of learner and teacher and their belief about praxis shows discrepancy. That means more teachers accept or at least do not object the role of teacher as facilitator, fewer of them accept the way of teaching that allows students to inquire their answers without a final model answer. It has been reminded by O’ Loughin (1986) that only studying the core belief of teachers is not an accurate prediction of teachers’ action, adding the study of teachers’ belief about praxis, the

accuracy of predication enhanced.

After the interviews, teachers Henry and Fanny of school (A) were selected as targets for the lesson observations, because they demonstrated the greatest variation in beliefs towards the principles of inquiry-based learning in school (A). Using the same criteria, teachers Alex and Peter of school (B) were also invited to be observed.

On the other hand, the result of questions (7) and (8) show that almost all teachers were able to list various teaching and learning strategies recommended in the PGS Curriculum Guide (see table 5.4). For example, the official guide notes that in the new inquiry-based curriculum students should

- *take a proactive role in the learning process to construct knowledge about the natural and man-made world*
- *become self-directed independent learner* (CDC, 2001, p.68)

In addition, teachers should use the following strategies as the major inquiry-based teaching strategies.

The following learning and teaching strategies have been used with success in many schools, both local and overseas; project learning, science inquiry……services learning. (CDC 2001, p.68)

To implement inquiry-based learning, students may be involved in different types of learning activities such as interviews, surveys, fieldwork, case studies, role-play, games, data collection and analysis. (CDC 2001, p.69)

In school (A) Henry, Sally and May listed more strategies while David and Fanny listed less. In school (B) Alex and Judy listed more strategies than Peter did. Some teachers mentioned "using Information Technology to learn and teach" which is the only extra strategy mentioned by

interviewed teachers that is beyond the recommendation of the PGS Guide. Such findings should also reflect the teachers' belief about praxis in implementing inquiry-based learning. Yet, the researcher suspected that the teachers may only have cognitive knowledge for the pedagogical requirement of inquiry-based learning and such knowledge may not have developed as teacher's belief. Hence further questions are needed for clarification.

Table (5.4) The result of questions (7), (8)

N=8

Teacher (school)	Teaching strategies?	How should students behave?
Henry (A)	-questioning -project works -group discussion -science experiments -interviews -fieldwork	-proactive learning -asking question -work in groups
Sally (A)	-using information -field study - questioning -group projects -surveys -role play	-collect information from internet -work in groups -inquire different topics
May (A)	-project works -science inquiry -services learning -using IT to teach -surveys and interview	-work proactively -study before lesson -use hand and brain to learn
David (A)	-questioning -assigning home projects -using internet and IT	-using IT to learn -collect information -doing project works

	-fieldwork	
Fanny (A)	-science inquiry - giving project works -survey	-doing project in group -collect and read information
Alex (B)	-group discussion -use more IT to teach -lead students to do projects -science inquiry activities -fieldwork	-work in groups -self-regulated learning -use computer to learn -ask meaningful questions
Judy (B)	-science inquiry projects -services learning projects -do not give too much instruction -role play	-work in groups -do science inquiry with assumption -self-disciplined in learning
Peter (B)	-science experiments -help students to learn proactively -interview -role play	-learn proactively -study learning materials before lessons

4. Questions detecting teachers' actual implementation of the curriculum

Q9. In your actual experience, what teaching strategies have you used in order to deliver the PGS lesson according to the principle of inquiry-based learning?

Follow up question:

How often did you use such strategies?

Q10. In your actual experience, what extra curricular activities have you organized in order to promote students' inquiry- based learning?

Follow up question:

How often did you organize such activities?

Questions (9) and (10) provided opportunities for teachers to explain their classroom practices in facilitating inquiry-based learning, to see the

consistency between their behaviour and their beliefs. The answers were grouped in following table.

Table (5.5) The result of questions (9)and (10)

N=8

Teacher (school)	What teaching strategies used?	How often?	Extra-curricular activities organised?	How often?
Henry (A)	-group discussion -experiment -project works -role play	almost every lesson (project work twice a year)	-science day -visits	once or twice a year
Sally (A)	-group works -power point presentation -experiment	About two times a week	-science day -visits	once or twice in a year
May (A)	-power point -group discussion -role play	about two to three times a week	-science inquiry day	once a year
David (A)	-group discussion -power point	about once a week	-science inquiry day	once a year
Fanny (A)	-group discussion	Sometimes, may be once or twice a week	-science inquiry day	once a year
Alex (B)	-science inquiry activities -group works	spread over in every lesson (project	-exhibition -visits -science inquiry activities	different activities in every week

	-giving projects -discussion -field trips	works twice a year)		
Judy (B)	-group discussion -project works -use E books and other IT materials	every lesson	-visits -exhibition -science day	different activities in every week
Peter (B)	-mainly group discussion	Three to four times a week	science day	twice a year

By looking at the table (5.5) one can see that teachers in school (B) adopted inquiry-based teaching methods in lessons and in extra-curricular activities more frequently than teachers from school (A) did. In addition, when comparing the answers of questions 9, 10 with questions 7, 8, the result shows that the variety of teaching strategies actually adopted by the teachers in both schools (answers of questions 9, 10) was less than that was mentioned (answers in questions 7 and 8). The difference between mentioned strategies and implemented strategies is illustrated in table 5.6.

Table (5.6) Comparing the mentioned strategies and implemented strategies

Teacher (school)	Number of mentioned strategies	Number of implemented strategies	item different	Item match
Henry (A)	6	4	2	3

Sally (A)	6	3	3	0
May (A)	5	3	2	0
David (A)	4	2	2	1
Fanny (A)	3	1	2	0
Alex (B)	5	4	1	4
Judy (B)	4	3	1	0
Peter (B)	4	1	3	0

Henry, Sally and May of school (A) and Alex of school (B) mentioned more number of inquiry-based strategies than others did. Yet only Henry and Alex actually used more such strategies than others did. Further, it is also only teacher Henry and Alex used the strategies items they mentioned, they both got three and four implemented items that match what they mentioned, comparing to zero and one item of others. In other words, even though other teachers named different teaching strategies for inquiry-based learning, they seldom used them.

In addition, Henry and Alex who used most number of inquiry-based teaching strategies, also expressed relative positive belief towards the basic principles of inquiry-based learning (see figure 5.1) as answering

question number (6).

For the question about extra-curricular activities, teachers of the same school provided similar answers. This may be because teachers usually work together to organize extra-curricular activities instead of organizing such activities individually. The variety of inquiry-based extra-curricular activities in school (B) was more than that of school (A).

Overall, when employing the concept of "theory in action" of Sigel (1985), the result demonstrates that most teachers understood cognitively the basic operation of an inquiry-based lesson. However, it does not mean that all of them would actually adopt these teaching strategies since such knowledge may not have developed as "theory-in-action" (Sigel 1985). Therefore, some teachers have stronger beliefs and such beliefs may have developed into teachers' theory-in-action, they used more such strategies (e.g. Henry and May of school A and Alex and Judy of school B). Some other teachers have weaker belief, such beliefs have not developed into teachers' theory in action, and thus they adopted less such approaches (e.g. Fanny of school A, Peter of school B).

5. Effect of inquiry-based learning

Q11. In your experience, what have the students actually changed in their learning behaviour in the PGS lesson since the implementation of the new PGS?

Q12. In your experience what are the benefits of the inquiry-based learning to students?

Questions (11) to (12) are two complementary questions asking teachers to comment the effect of inquiry-based method on students. The responses are presented in following table.

Table (5.7) The result of questions (11) and (12)

N=8

Teacher (school)	What have students changed?	What are the benefits of inquiry-based learning?
Henry (A)	-more proactive attitude -better learning skill -more discussion among students	-proactive attitude -more interest in science and PGS
Sally (A)	-show more interest -happier at lesson	-more interest in PGS -learn to learn
May (A)	-more positive attitude -love to do experiment - sometimes talk too much	-perhaps learn science better -not much benefit has been seen
David (A)	- sometime discipline problem become worse -result became worse in test and examination	-better communication -but bring out new problems like playing too much
Fanny (A)	-noisy classroom -not much change have been seen	- not seen other benefits yet
Alex (B)	-show better skills in communication and collaboration -learn the thinking logically -better understanding to concepts relating to science -more interaction among students	-lean to learn -learn to inquire knowledge -improvement in generic skills
Judy (B)	-better group work skills -more discussion -better skills in doing project works -more interaction with teachers and fellow students -show more interest	-benefit students' future learning -benefit students' interpersonal skills -benefit students' learning ability -better thinking skills also

Peter (B)	-more discussion among students -but junior students sometimes lose control of themselves -more discipline problems	-may bring benefits to older students but not in junior level students. -only more excitement was seen but not other overall benefit.

Teachers of school (B) mentioned more positive changes or benefits than that of school (A) teachers. Teachers of school (B) each provided from one to five positive changes while teachers in school (A) each provided from zero to three positive changes. On the contrary, teachers of school (A) provided five negative changes in total while teachers of school (B) provided only two negative changes in total. The benefits of inquiry-based learning mentioned by teachers of school (B) were usually relating to the improvement in skills. Further, teachers of school (A) each mentioned zero to two items about the benefits of the inquiry-based learning while teachers from school (B) each mentioned one to four items about the benefits. Teachers from school (B) could point out benefits of improving in generic skills and thinking skills. Most of the teachers in school (A) mentioned the improvement in learning attitude and the increase in students' interaction they observed.

The answers to question 11 and 12 are simply the reflection of how different the teachers from the two schools saw the "outcomes of the theories in action" (Sigel, 1985) about inquiry-based learning. As mentioned, teachers from school (B) generally discovered more positive changes. That implies teachers of school (B) perceived more positive outcomes of the inquiry theory. When considering individual teachers Henry and Alex saw more positive outcome of the inquiry theory than other teachers did.

6. Challenges to teachers

Q13. In your experience what are the challenges of inquiry-based learning?

Follow-up question: How do these challenges affect your teaching?

Through answering question (13), teachers would identify any difficulty or challenge for inquiry-based approach. Their responses are as follows.

Table (5.8) The result of question (13)

N=8

Teacher (school)	The challenges of the inquiry-based learning:	How do these challenges affect your teaching?
Henry (A)	-tight teaching schedule -high teacher-student ratio -lack of support from school	No time to take care of individual student
Sally (A)	-tight teaching schedule -difficult to help students to prepare for the examination	Can't take care of the individual difference
May (A)	-tight teaching schedule -difficult to design test and examination paper -lack of training	Don not know how to lead an inquiry-based lesson exactly
David (A)	-too many students in a class -tight teaching schedule -classroom discipline	Worry about the discipline problem and therefore minimize the classroom activities
Fanny (A)	-tight teaching schedule -too much teaching content has to be cover -classroom discipline	Difficult to follow the steps of inquiry and at the same time catch up with the

		teaching schedule. Usually, inquiry give way
Alex (B)	-difficult to assess inquiry process -not enough teaching time -difficult to convince parents	Feel psychological pressure because inquiry takes time and preparation
Judy (B)	-tight teaching schedule -not enough training -difficult to assess the learning	Still not know exactly how to assess the inquiry process, therefore only assess the inquiry product
Peter (B)	-difficult to implement to young children -too much teaching content and too little time	Minimize classroom inquiry activities

The challenges and limitations mentioned by teachers of both schools were quite similar. The major challenges included tight teaching schedule, difficulties in assessing students' progress, classroom discipline and lack of training and support. Alex specially mentioned the factor of parents. In his articulation, he brought out the point that parents were not alert to the change of learning approach and they still insisted teachers to give traditional assessment.

In answering the follow-up question about the effect of such challenges, teachers mentioned specific impact they experienced. Some of the impacts are operational, for instance, not enough time to catch up with the teaching schedule, not know how to assess student's

performance and not know how to lead an inquiry-based lesson. Some others related to psychological factors, for instance, feel pressure from extra workload, worry about the discipline problem. The challenges mentioned by teachers reflect a major part of the "contextual influences on teachers' belief formation and practice" (Sigel, 1985). Some contextual factors may have hindered teachers from trying more inquiry-based method in lessons and caused teachers to believe that inquiry-based learning does not work in their schools.

7. Discrepancies between belief and reality, theory and practice

Q14. How were these experiences different from your expectation of inquiry-based learning?

Q15. What factors contribute to such difference?

Questions (14) and (15) asked teachers to reflect on their practice in inquiry-based learning to detect the discrepancy between the expectation and the reality. Teachers' answers are presented in the following table.

Table (5.9) The result of questions (14) and (15)

N=8

Teacher (school)	experiences different from expectation?	factors contributing to such difference?
Henry (A)	-more workload than expected -students responds were not so excited as expected	-the school policies did not support -teaching schedule too tight -too many students in a class
Sally (A)	-more difficult than expected	-too many students -lack of training in inquiry-based approach
May	-students were difficult to control	-students were too excited -inquiry-based learning

(A)	-teaching time was not so easy to control	need more teaching time
David (A)	-problems appeared as expected -e.g. discipline problem, difficult to assess	-teachers' workload was too heavy -students not prepared to lean in inquiry-based approach
Fanny (A)	-not much difference between expectation and experience -expected that such approach would cause confusion	-local teachers and students were not accustomed to such approach -school policies not support -parents lack understanding
Alex (B)	-much more time needed -much more preparation needed	-teacher-student ratio too high -too much teaching content
Judy (B)	-students needed more personal assistance than expected -teacher needed more time than expected	-take time to cultivate new learning habit
Peter (B)	-as expected, young students difficult to learn in such approach	-inquiry-based learning suitable for older students

The answers show that teachers carrying more positive belief towards inquiry-based learning show higher discrepancy between expectation and experience. For examples, Henry and Sally of school (A) and Alex and Judy from school (B) showed more positive belief towards the basic principles of inquiry-based learning (result of question 6) and they also claimed to adopt more inquiry-based teaching strategies in lessons (as showed in result for question 9), now, also encountered more problems. In other words, they found it more difficult to implement inquiry-based learning than expected. The common factors contributed to such

difference were lack of teaching time, too many students in a class, lack of training and lack of support from school and parents.

On the other side of the picture, those who showed less supportive belief towards inquiry-based learning or actually adopted less inquiry-based approach showed less disappointment in the actual result. For example, teacher May, David and Fanny of school (A) and Peter of school (B) showed that they did not have positive expectation towards the adoption of inquiry-based learning. In other words, they expected that inquiry-based learning would cause discipline and assessment problems, increase of workload and difficulties for teachers and they thought the results proved what they had expected.

Referring to Sigel's components of belief, this question further discloses teachers' observed outcomes of the inquiry theories and the contextual influence in the forms of contextual constraints and limitation in individual school.

8. Double checking belief in inquiry-based learning (belief about learning and teaching

Q16. Generally speaking, do you support the inquiry-base learning principle? Why?

Q17. Do you think inquiry-base learning suitable for local students?

Questions (16) and (17) asked teachers to conclude their viewpoints on inquiry-based learning. These questions were also used to double check the consistency of teachers' answers. The answers showed as follows.

Table (5.10) The result of questions(16) and (17)

N=8

Teacher (school)	Do you support inquiry-base learning? Why?	Is inquiry-based learning suitable for local students?
Henry (A)	-yes -help students learn by themselves	-yes -although it is difficult for teachers to handle
Sally (A)	-yes -students learning attitude has improved	-yes -but need more support from schools and government
May (A)	-yes but -students showed more interest in learning but they seem to learn less content	-yes -teachers may need more training before the actual implementation
David (A)	-yes but -if teacher-student ratio decrease and the assessment requirement change	-yes -on the whole inquiry-based learning is good to students
Fanny (A)	-it depends -traditional methods can help students learn more concrete content	-yes but -local students not as proactive as students in western countries, -I do not object an try on this new approach
Alex (B)	-yes, sure -it is the learning approach of the new era	-yes -it takes time to change the mind set of students, teachers and parents, therefore the earlier to implement the better.
Judy (B)	-Yes -students need to develop their own thinking abilities	-yes -The new PGS is a good chance to invent the new teaching and learning methods.

Peter (B)	-it depends -it is not suitable for young students because they are too young to control themselves	-yes but -may be applied to older students first before launching it on all levels of students.

For question (16) and teachers in school (A), two of the interviewed teachers gave firm and positive answers, the other two gave positive answers with reservation and one of them gave a neutral answer. For question (17), the situation was a little bit different, four out of five teachers of school (A) gave firm and positive answers and one of them gave positive answer with reservation. The answers from teachers of school (B) for question (16), two out of three teachers gave positive and answers. The situation is similar for answering question (17), two out of the three teachers gave firm and positive answers while one of them gave positive answer with reservation.

As these two questions were used for counter checking the beliefs of the interviewed teachers, the following results were discovered.

1. Judging from the answers of question (16), it shows that some teachers were consistent in their standpoints while some were not. Henry of school (A) and Alex of school (B) were showing supportive belief towards inquiry-based learning in answering question (6) and they also provided positive answers in question (16). On the other hand, teachers David and Fanny of school (A) showed negative belief towards inquiry-based learning when answering question (6), were giving “yes but” answers in question (16) and (17). That means although they hold negative belief towards the substantial principles of inquiry-based learning, they do not openly object the adoption of

such approach or gave verbal support to the adoption of such approach.

2. However, the answers of May of school (A) were not so consistent. She showed negative belief towards inquiry-based learning. She was situated at the left hand side of the continuums and yet she gave positive responds to questions (16) and (17). In fact, during the interview she seemed to change her attitude gradually. For example when asking about the changes she noticed from her students she also provide some positive responses. Similarly, Sally of school (A) and Judy of school (B) showed neutral attitude when answering question (6), changed their attitude when answering questions (16) and (17) from neutral to positive attitude (see table 5).
3. The result of question (17) showed a contradictory phenomenon. As almost all teachers supported the adoption of the inquiry-based approach in the new PGS to local students, some of them had actually expressed opposite comments on the results of adopting of such approach. In answering question (11) and (12) which were about the changes of students' learning behaviour, May, David and Fanny of school (A) and Peter of school (B) were giving negative responses. It gave the researcher an impression that these teachers treated inquiry-based learning as something with theoretical values but not practical effectiveness. Hence, when they were asked whether inquiry-based learning suitable for local students (question 17), they gave positive answers. However, when they were asked bout the actual benefits of adopting inquiry-based learning for students (question 11, 12), they mentioned many problems. Such contradiction

also implies the difference between teachers' core belief, belief about praxis and the perceived outcome of the theory in action (Sigel 1985). It may reflect that teachers only believe in the "value in theory" of inquiry-based leaning but do not see the "value in practice" (the outcome of the theory in action), thus they may not act according to such approach.

5.5 **A summary of the initial interviews**

The initial interviews not only disclose the background information and beliefs of the target teachers, but also unveil following results. If we take into account teachers' background, some interrelationship may be identified. Henry and Alex are panel chairpersons of the PGS subject in school (A) and (B) respectively, they were also educated or trained with science discipline. The result shows that they were situated approaching the right hand side (the side that support the basic principles of inquiry-based learning). Logically speaking, they should have received more training for the new inquiry-based curriculum and they have a political and professional mission to support the new teaching method. Therefore, their positive attitude may be explained. Other correlation between teachers' background and their beliefs were not obvious. Besides teachers' background, other findings from the initial interviews are also detected. Generally speaking, although there are more teachers holding negative beliefs towards the two basic principles of inquiry-based learning in both school (A) and (B) (only Henry of school A and Alex of school B in the support side), school (B) teachers' adopted more inquiry-based teaching strategies than teachers of school (A) did. Teachers of school (B) were also better aware of the inquiry nature of the new PGS. The

teachers of school (B) also saw more concrete-benefits from inquiry-based learning. However, almost all of the interviewed teachers used fewer inquiry-based teaching strategies than they actually knew. The teachers, who showed more positive-beliefs in inquiry-based learning, also claimed that they used more inquiry-based teaching strategies in lessons. In detecting the challenges of inquiry-based learning, lack of teaching time and difficulties in assessment are the two major challenges mentioned by teachers in implementing inquiry-based learning.

By referring to Sigel's (1985) components of belief, one may summarize that the initial interviews provide useful information on the following aspects. The sources of belief of the teachers (their bibliographical background), teachers' core belief and belief about praxis (teachers' beliefs towards the basic principles of inquiry-based learning), the contextual influence on belief formation and practice (the challenges and difficulties teachers encountered) and teachers observed outcomes of the inquiry theory (teachers observed changes in students' learning and their own teaching).

5.6 Implication to the theoretical framework

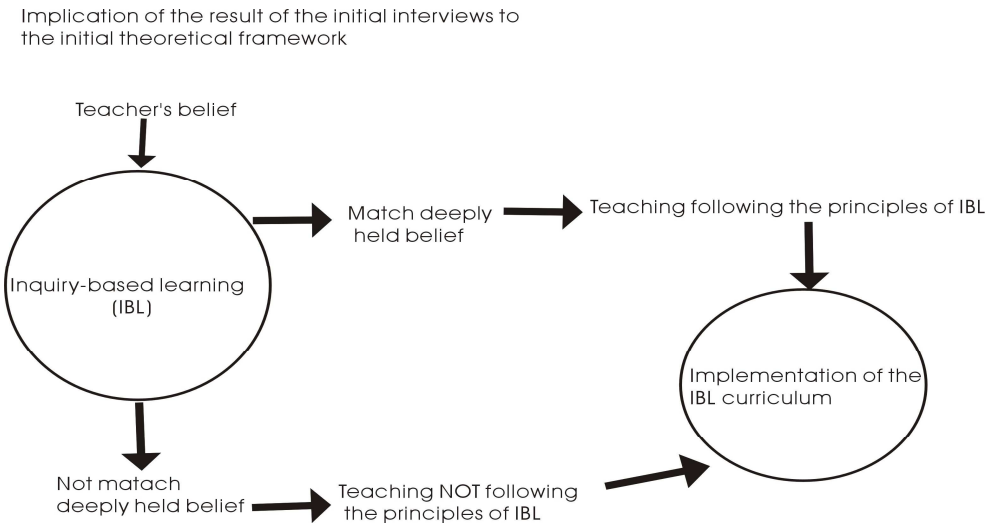
As the implications for the theoretical framework, following insights were noticed from the result of the initial interviews (see figure 5.2).

1. Although all teachers verbally support the concept of inquiry-based learning, many of them rejected the principles "*teacher as facilitator*" and "*inquiry is not much about seeking the right answer*". It reflects the broad definition of inquiry-based learning teachers held, some teachers might only accept the elements that do not seriously alter their conventional practice or established beliefs towards learning and

teaching.

2. By comparing questions number 6. 7. 8 and 16. 17, most of the interviewed teachers were consistent in their beliefs towards inquiry-based learning. However, there was contradiction in that most of the teachers believed that inquiry-based learning is suitable for students and yet many of them did not actually adopt such an approach in lesson. It implies that teachers accept the theory of inquiry-based learning in a cognitive sense, they may not actually implement it because such new beliefs may not be strong enough to change their behaviour since it has not developed into deeply held belief yet (see figure 5.2). As it has been discussed in the literature review (Archer, 1999) that teachers' decisions are based on deeply held beliefs about teaching. Beliefs, once firmly established, are difficult to change. Teachers may even selectively choose information that confirms their beliefs, even to the point of distorting evidence to make it fit.
3. The challenges teachers mentioned and the difficulties they encountered reflect both the pedagogical requirement of inquiry-based learning and influence of contextual factors on teachers' beliefs and practices in the target schools. It echoes the inference of the theoretical framework (see figure 2.1) that the special requirement of inquiry-based learning, together with other contextual factors affect teachers belief formation and belief in praxis (Sigel 1985).

Figure (5.2) Implication of the result of the initial interview to the theoretical framework



5.7 Further areas to look at

After the initial interviews, following questions and focuses emerged. These new concerns subsequently became part of the focusing areas for the data collection procedures following.

1. <u>The school's positioning for PGS</u>

   In the section of documentary analysis, positioning for the new PGS of the target schools will be the first area to look at. It is to see whether the answers of teachers were based on their own will or they just copied the official ground from their schools. Since Hart (1996) argued that changing teachers' practice requires changing their conception of the job rather than encouraging them to adopt certain practices whilst abandoning others. In case, teachers were only repeating what they were asked to do or no to do, their actual teaching behaviour might not have changed in substantial sense.

2. <u>The consistency between the initial interview responds and the actual</u>

classroom practice

It was decided at this stage that Henry and Fanny from school (A) and Alex and Peter of school (B) will be observed in their PGS lessons. This is justified because these four teachers represent the two different types of beliefs in inquiry-based learning, although there were still variations in their beliefs content. On the one hand, Henry from school (A) and Alex from school (B) were more positive in accepting the inquiry-based concept as prescribed by the PGS Guideline. They also presented in their interviews that they have put more effort in making this learning method a success. On the contrary, Fanny had the greatest reservation about the principles of inquiry-based learning; she indicated that not much difference was found in her lessons. Peter showed greater concern about the implementation of such method in junior level although he claimed that he had tried hard to overcome it. Certainly, one major focus to look at during the observations will be the consistency between teachers' interview responses and their actual classroom behaviour.

3. Non-science inquiry

All teachers from school (B) showed that they saw science inquiry learning as the core of the inquiry-based learning in the new PGS. Hence, special interest has to be paid to lessons of non-science content, for example, lessons about social studies or history learning, to see whether teachers only take science content into inquiry approach. It has been indicated in the literature review (e.g. Anderson, 1998); it is a common phenomenon that teachers would mix up the concepts of "inquiry-based learning" with "science inquiry". Coupled with the fact that, the inquiry-based learning introduced in the PGS Guide is not limited to

science inquiry therefore it is important to clarify whether teachers of school (B) only interpret inquiry-based learning as something for science content only.

4. The role of Information Technology (IT)

   IT, as mentioned many times by teachers of the targeted schools, is a major means to facilitate inquiry-based learning. Special attention would therefore be paid to the use of IT at lessons. It is currently under argument whether IT and a Web-based simulation environment are powerful tools for enhancing inquiry learning process (e.g. de Jong & Van Joolingen, 1998; Kuhn et al. 2000; Abrams et al. 2001; Reid et al.2003) or they do not have a positive effect on learning concepts and skills comparing to the effects with those of more traditional methods (e.g. de Jong & Van Joolingen, 1998; Lee 1999). Hence it was decided at the point that IT was another area worth investigating.

5. The major challenges of inquiry-based learning

   As indicated in the initial interviews, difficulties of assessment and the shortage of teaching time were described as the greatest challenges for inquiry-based learning for the new PGS. For the problem of assessment, Alberta Learning (2003) found that in relation to the inquiry process, learning is enhanced when assessment is also designed in inquiry-based direction. That means assessment is not only a routine of the inquiry-based learning but a crucial instrument for the successful inquiry-based learning. Therefore, it is essential to focus on it. For the problem of teaching time, Beck and others (2000) shared similar findings in their study of teachers' belief and implementation of constructivism in classroom that teachers find themselves in short of teaching time when

adopting constructivist learning and teaching methods. As a result it was also determined at this stage that assessment and limitation in teaching schedule will be the problems the researcher pay attention to, in the sections of classroom observation and in-depth interview afterward.

Chapter 6

Phase One of the study: Report of the school documents analysis

6.1 Purpose of the documentary analysis

Documentary analysis is one of the beginning stages in this study. It follows the initial interviews and it is benefited from the findings of the initial interviews. The findings from the schools' documents also help the researcher to (1) understand better the general background of the target schools, especially for their policies in implementing the new inquiry-based curriculum, (2) detect the beliefs of the teachers and the school administration and (3) identify further hidden focus.

Alberta Education (2004) suggests that the planning phase of inquiry is the key to success for teachers. Teachers who plan successful inquiry-based learning activities should take the time to think through the process. Therefore, the analysis of the following documents not only provides general information about the schools and the teachers, but more important, it unveils the situation of the planning phase of the teachers in preparing the implementation of an inquiry-based curriculum. The documents of the target schools were analyzed with a checklist (see appendix 2) which was designed according to the suggestions of Exline (1995).

6.2 Description of the documents

The researcher obtained from school (A) a copy of the PGS handbook (Chinese version) prepared by the school. It actually includes all the information and instructions that the PGS teachers need to know in order to

perform their duties at school (A). On the other hand, school (B) arranged for the researcher to read a collection of PGS meeting minutes of the school, which recorded the meetings starting from September 2006 to July 2007.

6.2.1 Document of School (A)

The handbook of school (A) consists of 13 sections. They are as follows.

1. The principles of the curriculum
2. The learning outcomes
3. The learning areas

   (Much of the content of these three sections was extracted from the PGS official guide of the authority.)
4. The arrangement of the curriculum

   (This includes the number of PGS lesson in each week and the teaching schedule that states clearly the schedule for each topic and the period for examinations and tests. The school allocates four PGS lessons per week and it is one lesson less as compared to the official guide.)
5. Teaching and learning

   This mainly delineates the principles and direction in organizing the teaching and learning activities. It is clearly stated in the section that:

   ……*teacher should encourage students to inquire their environment and let student take the active role in learning*. (p.3)

   The definition of inquiry-based learning prescribed by the CDC is also quoted in this section.
6. Textbook

It notes the adoption of the version and publisher of the PGS textbook.

7. Home work and assignment

   a) Objectives for giving homework

   b) Ways to design effective PGS home work

   c) Rules and quantity of home work

8. The guideline for assessment

   a) The principle of assessment in PGS

   b) The school's policy for assessment

   c) Methods of assessment

9. The teaching resources
10. Extra curricular activities
11. Reflection on teaching
12. The safety instruction in PGS
13. Appendix

6.2.2 Document of School (B)

The basic format of the meeting minutes of school (B) are as follows.

1. Follow up items of last meeting
2. New items for discussion

   (For the meetings in September 2006 and January 2007, which was the first meeting before the school year 2006-2007, the schedule for lessons and assessment was recorded in the minutes. Teachers' workload and division of labour inside the panel were also noted in this section.)

3. Problems and difficulties

   The documents showed that most of the time teachers were discussing problems and challenges, which emerged from PGS lessons. Discussion

points including:

a) Difficulties in handling students' discipline during the PGS lessons

b) Difficulties in assessing students

c) Parents' complaints about the difficulties in helping their children to prepare for the examination

d) Ways to encourage students to participate the inquiry process in lessons and at home

4. Extra curricular activities

In each meeting, teachers briefly discussed the coming extra curricular activities for PGS. According to the documents, science investigation days and outside visits were the major extra curricular activities for the PGS subject.

6.3 Have the schools prepared for inquiry-based learning?

Exline (1995) (see section 3.2) defined a list of teachers' effective behaviour in preparing and leading the inquiry lessons. The first two suggestions of the "six stages of lesson planning" of Exline are:

1.*Plan ways for encouraging learners to engage in the learning process,*

2.*Plan ways to encourage learners to take increasing responsibility for his learning* (see appendix 2).

In school (A), these two aspects were illustrated at the section of "Teaching and Learning" inside the document of school (A) as the document (the PGS handbook of school A) states that it is the school policy to place students as the center of learning (p.8). In the details, it was also found in the document that teachers prepared project learning and science inquiry activities for PGS lessons and for extra curricular activities. For instance, in

year 2006 and 2007, there were project works with the themes "s*chool as a family*" for primary one (6-7 years old), "*the parks in my district*" for primary two (7-8years old), "*the transportation in Hong Kong*" for primary three (8-9years old) , "*Hong Kong , today and before*" for primary four (9-10 years old), and "*emigration to the space*" for primary five (10-11) and six (11-12 years old).

In school (B), one can tell from their meeting minutes that teachers of school (B) were putting effort in planning ways for helping students to engage in the learning process actively. Actually, many discussions in the meetings were about practical measures to help students to take active roles in PGS lessons. For instance, at the meeting of Sept 2006, teachers decided to add a new training course on the school web site for helping students to do their group projects. Teachers also discussed, for many times, the measures to overcome the difficulties they encountered when they tried to motivate students in lessons. For example, Alex, the panel chairperson, has once suggested a competition on the gathering of information about the 2008 Beijing Olympic Games (meeting of Nov. 2006).

For Exline's third suggestion, "*ensure that classroom learning is focused on relevant and applicable outcomes*" (see appendix 2), the section two of the school (A) document listed the learning objectives of the PGS. As mentioned before, these objectives were extracted from the official PGS Guide. Furthermore, it can be seen from the handbook that there were clear goals for the whole subject. However, it was not possible to tell from the handbook whether these goals were applicable outcome or not. The same situation also appeared in school (B) although the meeting minutes were attached with teaching schedules, in which, learning outcomes for each

teaching unit were listed out; there was not enough evidence to assess the quality of the learning objectives of their PGS lessons. The only way to assess the applicability of the pre-designed learning outcomes is to observe and analyse the real lessons and it is the task of the coming research procedure.

For Exline's fourth suggestion "*prepare the classroom environment with the necessary learning tools, materials, and resources for active involvement of the learner*" (see appendix 2), section nine of the PGS handbook of school (A) showed that lists of teaching resources were prepared for the PGS lessons. Those resources included CD ROMs and other teaching and learning aids. Judging from the lists, such resources should have helped students' self-regulated learning and inquiry process. However, it could not be told from this document, whether these resources were easy to access by students or under complicated administrative procedures that might hinder the willingness of students to use them frequently and freely.

In the same aspect, there was evidence from the meeting minutes of school (B) showing that teaching and learning resources, especially audio and visual aids were well managed. One of the PGS teachers was responsible for managing the resources. According to one of the meeting minutes, students were encouraged to use the computer room and the school campus facilities (Meeting of Sept. 2006).

For Exline's fifth suggestion "*set content learning in a conceptual framework, stress skill development and nurture the development of habits of mind* " (see appendix 2), the handbook of school (A) states clearly in sections one and five that development of student's generic skills is one of the school policies. Not much has been mentioned directly in school (B) document

about the student's skill development and training of mind except in the first meeting in September 2006. At that meeting, the basic rationale of the PGS was introduced. The panel chairperson reminded the teachers that all PGS lessons should be inquiry orientated. The training of thinking skill was obviously one of the rationales mentioned in the inquiry approach.

For Exline's sixth suggestion "*make student assessment an ongoing part of the facilitation of the learning process*" (see appendix 2), relevant clues could be found in section eight of the PGS handbook of school (A). This section was about the assessment of learning. Inside, it could be seen that coursework (the school call it formative assessment) was a policy of the school; however, summative assessment; the final examination still played a crucial role in the whole assessment plan. Among the whole assessment system, the percentage of marks for formative assessment is 20% only. For school (B), much attention has been paid to the methods of assessment; different methods were mentioned in the meeting minutes; such as rubrics for assessing project learning, short quizzes and assessment for in-group discussion of students. Teachers used them for formative assessment especially in assessing the generic skills and knowledge and yet formal tests and final examination still existed in this school and the percentage of marking for coursework (the teachers classified it as formative assessment) is 30%.

Hence, generally speaking, the documents from both schools indicated that PGS subject was positioned as an inquiry-based subject and teachers did try to plan the lessons in a way that was in conformity with the principle of inquiry-based learning, when evaluating with the criteria of Exline (1995). Nevertheless, it was obvious that the PGS handbook of school (A) was

simply a copy of the official PGS Guide. As the official guide was actually written according to the inquiry-based approach, the school's PGS handbook would surely looks very inquiry orientated. However, there was in fact very little school–based interpretation inside the handbook. Logically speaking, it was the safest way to prepare a school document like that, because, one of the major functions of such documents was for government inspection. Since all the ideas and instructions were employed from the official guidelines, the school is secure from any criticism of deviating from official direction or principles. Therefore, it is difficult to tell from the documents of school (A) whether it reflects the beliefs of the school administration or it is just a duplication of the government viewpoints in the PGS. Yet, it provides at least the evidence that the school administration accept the official beliefs about learning and teaching for the new PGS.

The situation was a little bit different in school (B). Teachers themselves initiated most of the discussions about inquiry-based learning. Judging from the mindsets of teachers as reflected in their discussions in the panel meetings, the teachers did try hard to make inquiry-based learning a success, although there were difficulties and challenges and not all the three teachers adopted various inquiry-based teaching strategies all the time. They did try hard to think before the lesson and planned for the implementation of the new PGS. Therefore, the document examined in school (B) provides additional evidence that the teachers in the PGS subject panel generally believe in the inquiry direction of the PGS and they did prepare the implementation in conformity with the inquiry-based direction when judging with the suggestions of Exline (1995). In addition, as the panel meeting minutes have already filed by the school administration, and it has been

confirmed that the school has not issued any handbook for any subject, it is reasonable to say that the school administration has approved the conclusions reached in the meetings and it reflects the belief of the administration indirectly as well.

6.4 Comparison to the findings of the initial interviews

According to the design of this study, the findings from the initial interviews will be compared and contrasted at every stage of the following procedures in the study. Hence the following paragraphs explain the results of comparison between the findings from initial interviews and that from analysing schools' documents.

6.4.1 Teachers' belief or schools' belief

As mentioned in the analysis of the initial interviews, it is important to see clearly that whether the viewpoints expressed by the teachers about inquiry-based learning were personal beliefs or they were just the reproduction of the official standpoints of their schools.

As indicated in the initial interviews, most of the school (A) teachers, except Alex, held reservations on the basic principle of "*teacher as facilitator*" and "*inquiry is not about seeking the right answer*". Nevertheless, it was clearly stated in the PGS handbook of school (A) that *"teachers should allow students to have the autonomy in learning"* (School A, PGS Handbook p.3) and "*the current knowledge of the subjects will soon become obsolete therefore, it is teachers' responsibility to foster students' generic skills*" (School A PGS Handbook, p.4). It follows from what has been seen that most of the teachers in school (A) expressed their own viewpoints and

concerns for some basic principles of inquiry-based learning, rather than accepting the official language of the school. They understood inquiry-based teaching strategies but they held reservation and concern on the practical aspect as well as the theoretical rationales of this new teaching and learning method. Referring to Sigel's (1985) components of beliefs, the core belief and the belief about praxis of the school administration are different from that of some interviewed teachers. Further, the school administration as an "agent inducing the change in belief" about inquiry-based learning has not done her jobs effectively as most of the PGS teachers are still carrying deviated beliefs from that of the school administration.

There was no evidence found in the school (B) document that the school has set out any definition or standpoint about inquiry-based learning. The only discussion on this matter happened in the first panel meeting before the school year. In that meeting, the panel chairperson reminded the teachers one of the basic rationales of the new PGS was inquiry-based learning. No controversy was recorded. Relatively speaking, teachers in school (B) expressed supportive attitude towards inquiry-based learning, in the initial interviews, even though Peter had some concerns for its application on junior level students. Explaining in Sigel's (1985) components, one may say that the core belief and belief about praxis carrying by the PGS teachers should be at least accepted and approved by the school administration and the school administration of school (B) may have done a better job in inducing the change in belief about inquiry-based learning although teachers' previous belief was not known.

Viewed in this light, teachers' beliefs as expressed in the initial interviews can be regarded as their own wills and it thus reflects that teachers

of school (A) generally carrying different beliefs from that of the school administration or even the official guide of the PGS (except teacher Henry).

6.4.2 Non-science inquiry

As indicated in the interviews for school (B) teachers, they paid much attention to the science inquiry activities and it gave the researcher an impression that they might have used inquiry-based methods in science related content only. Since PGS is about "science", "health education", "social and cultural studies" and even "the education of national identity" as prescribed in the PGS Curriculum Guide; science learning is only a portion of the PGS. As mentioned in the literature review, science inquiry is one of the origins of inquiry-based learning (Dewey, 1938b; Anderson, 1998) and there is a possibility that teachers might have confusion that the inquiry-based learning principle only applies on science related content. Fortunately, the meeting minutes of school (B) show that teachers were well aware of the importance of planning inquiry-based teaching and learning on content beyond science content. For examples, they discussed the ways to encourage group inquiry for social issue of pollution in primary four (at November meeting, 2006); the family inquiry for ancestors' history in primary three (at November meeting, 2006) and personal inquiry-based learning on the importance of friendship in primary six (March meeting, 2007).

6.4.3 The role of IT

Teachers in school (A) mentioned in the interviews that IT was a major tool they used to facilitate inquiry-based learning at PGS lessons. The

handbook of school (A) indicates that the school has prepared sets of CD ROMs for teaching PGS (School A PGS handbook, p.14). The handbook also shows that textbook publisher has provided the school a set of electronic books (E Books), which contains all the content of the textbooks. The E Books could be presented flexibly by using computer and projector. However, the handbook shows no guideline in using IT to teach PGS.

A similar situation appeared in school (B). Although teachers have discussed the use of IT in helping students to learn through inquiry for many times, not much evidence have been found indicating the schools' position in adopting IT to facilitate inquiry-based learning except an on-line course for doing project works has been discussed.

It may show that using IT to assist the delivery of the PGS lessons were the choices of teachers rather than that of the school administrations in both schools.

6.4.4 The major challenges of inquiry-based learning

Almost all interviewed teachers mentioned the difficulties in assessment and tight teaching schedule as the major challenges for inquiry-based teaching. The documents from both schools did prove that the teaching schedule was tight. There were only four PGS lessons in both school (A) and (B) while the official PGS Guide recommended at least five lessons a week for this subject, in spite of the fact that there were surely other interruptions during the school year.

For the problem of assessment, the documents of the two schools show that coursework was encouraged; yet final examination still played a crucial role. Under such circumstances, teachers might have to pay double effort to

help students. As disclosed in one meeting of school (B) that parents place pressure on teachers, complaining the unfairness of coursework. Parents raised questions on fairness and difficulty to help their children to obtain good result in project works. It also reflects in the meeting minutes of school (B) that teachers faced challenge in assessing the inquiry process, the generic skill and the attitude in inquiry.

6.5 Summary of the documentary analysis

Because of the limitation imposed by the target schools, the researcher could only access some of the documents related to PGS but not all relevant documents. However, it was in any sense a fruitful finding by reading those documents.

1. The schools' documents indicates that the policies of the target schools were basically in tune with the direction as Exline (1995) suggested for facilitating inquiry-based curriculum.
2. It has been found that teachers' opinions expressed in the initial interviews were basically their own viewpoints and beliefs.
3. Teachers of school (B) were allowed more freedom and autonomy in planning the PGS lessons and they did plan it in the way which favours inquiry-based learning. On the other hand, teachers from school (A) were instructed to follow the official guideline in planning the PGS and few school-based ideas were found.
4. The documents also confirm the ground for teachers' worries about tight teaching schedules and difficulty in assessment as disclosed in the initial interviews.

Judging from the documents only, one may say that the target schools were

giving basic support to inquiry-based learning and yet they still maintained some policies that might have hindered the development of inquiry-based learning, for example, the standardized tests and examinations that required much recalling of facts and information.

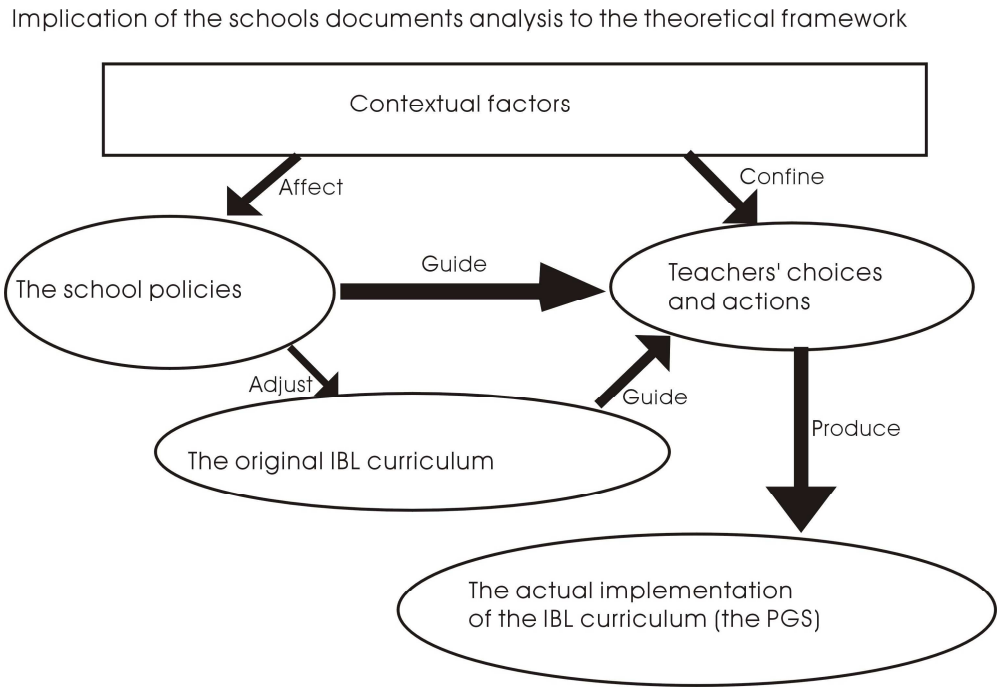
6.6 Implication to the theoretical framework

Besides verifying the analysis of initial interviews and providing new focuses for the data collecting procedures following, the analysis of documents also contribute to the theoretical framework of this study. The documents of the target schools provide further evidence for the operating of the contextual influence on teachers' belief formation and practice (Sigel, 1985). Such influence is sometime in the form of constraints and limitation for teachers (e.g., the tight teaching schedule, the complicate procedure for assessing the IT resources) and hence confine teachers' choice of teaching strategies (see figure 6.1). Such constraints may have influenced teachers' beliefs about the effectiveness and function of inquiry-based learning and caused teachers to think that inquiry-based learning is not suitable for their schools.

In addition, as "the agent inducing the change in belief" (Sigel, 1985) about adopting inquiry-based learning in the PGS subject, the relevant school documents provide evidence about schools' policies. As mentioned, the handbook of school (A) is mainly derived from the official PGS guideline; hence it bears the same function in facilitating the implementation of inquiry approach. However, the extent teachers in school (A) would follow the handbook is still in question at this moment. One important point is sure that the opinion expressed by teachers of school (A)

are not completely following the school's standpoint. On the other hand, the meeting minutes of school (B) denote the importance of the PGS panel meeting as the agent inducing the change in belief about inquiry-based learning. Discussion among teachers and consensus reached about designing the PGS activities and assessment show the strength and binding of professional practices among the PGS teachers in school (B).

Figure (6.1) Implication of the schools documents analysis to the theoretical framework



6.7 Questions emerged from the schools' documents analysis

The following questions were yielded from the documentary analysis and were followed up in the data collection procedures following.

1. To what extent did the PGS teachers in the school (A) and (B) follow the school policies as prescribed in the documents?
2. Had summative assessment (examination and test) hindered

inquiry-based learning?

3. Why teachers relied so much on IT when teaching the PGS lessons?

These questions were addressed in the stage of analysis of students' works and lesson observations following.

Chapter 7

Phase one of the study: Report of the students' works analysis

7.1 Description of the students' works

The purposes of the analysis of student's works are to provide further information on school's policies in assessment of students and to investigate teachers' beliefs as implied in designing and marking the assignments. The collection and inspection were divided into two phases. In the first step, the researcher collected students' works from all classes of both target schools with a random system that the works of students with class number 10 were collected. The purpose for the step one inspection is for comparing the assignments of the two target schools and the marking habits of the teachers in general. In the second step, another 4 sets of students' works were examined. Those students' works came from the classes taught by the teachers who were selected for lesson observation (i.e. Henry and Fanny of school A; Alex and Peter of school B). The researcher requested the school administrations to collect the sets of works from students with class number 15 and 30 for a random purpose.

The first step inspection generates results about the assignments of the target schools. The general description of the works is illustrated in table (7.1). The second step inspection is illustrated in table (7.2)

Table (7.1) students' works analyzed in step one

School/ level	**Types of works**	**Purpose (explained by the teachers)**	**Description of the assignment content (analysed by the researcher)**
School A Primary 1 to Primary 6 (1 set from each class/12 sets in total) Total number of classes in this school =12	PGS workbook	-consolidation of knowledge	-designed and published by textbook publisher -match the topics of the textbooks -question types included fill in the blanks, true or false, multiple choice and picture study -required answers are fixed and standardized
	PGS worksheet	-consolidation of knowledge -skill learning -extension study of the lesson	-designed and published by textbook publisher -match the topics of the textbooks -question types included fill in the blanks, true or false, multiple choice, picture study, class activities (e.g. recording the simple experiments, recording the results of group discussion) -most of the answers are fixed and some answers are open-ended

	PGS projects	-training of generic skills -as extension of the lesson	-designed by the teachers -project works only assigned to students of primary 3 or above -for primary 1 and 2, projects reports were collection of information for specific topics only -for primary 3 and above, the products were report booklets made by students -inside the report booklets, different styles and flow of content were found, yet, it usually included titles of the projects, names of group members, presentation of the project content and reflection of the process in doing group works -pictures, photos and writing were found in the reports -some projects works were done in a detail and systematic style while some of them were roughly done only -students' own ideas and comments could be found in some of the project reports
School B Primary 1 to Primary 6 (1 set from each class/8 sets in total)	PGS workbook	-consolidation of knowledge	-designed and published by textbook publisher -match the topics of the textbook -question types included fill in the blanks, true or false, multiple choice, picture study and matching. -required answers are fixed and standardized

Total number of classes =8	PGS worksheet	-record of inquiry activity -skill learning -extension study of the lesson	-designed by the teachers -not exactly match the content of the textbooks -question types included multiple choice, picture study, class activities and home works (e.g. recording the simple experiments, recording the results of group discussion, report of home experiments and collection of information and news) -about 60% of the answers were open-ended, students have to write their own answers especially for senior level students
	PGS projects	-training of generic skills -inquiry-based learning	-designed by the teachers -project works only assigned to students of primary 2 or above. -for primary 2 and 3, projects works were a series of worksheets designed by teachers. -for primary 4 and above, the products were report booklets made by students -inside the report booklets, a common content flow was found, which included title of the project, names of group members, presentation of the project content and reflection of the project works. -inside the reports, there were writing, pictures, graphics, photos and collected information. -most project works were done in a systematic and thoughtful style while some of them were roughly done only -students' own ideas and comments could be found in most of the project reports

Table (7.2) students works analyzed in step two

School/ Level/ teachers	**Types of works**	**Teacher's marking**
School A Primary 4 (Henry's classes)	PGS workbook	"✓" or "X" for each answer No written comments, graded with A, B, C, D
	PGS worksheet	"✓" or "X" for each answer No written comments, graded with A, B, C, D
	PGS Project works	"✓" at the end of each section of the report A few written comments , graded with A, B, C, D
Primary 2 (Fanny's class)	PGS workbook	"✓" or "X" for each answer No written comments, graded with A, B, C, D
	PGS worksheet	"✓" or "X" for each answer No written comments, graded with A, B, C, D
	PGS Project works	"✓" at the end of each section of the report No written comments, graded with A, B, C, D
School B Primary 5 (Alex's class)	PGS workbook	"✓" or "X" for each answer No written comment, graded with A, B, C, D
	PGS worksheet	"✓" or "X" for each answer Many written comments besides the answers , graded with A, B, C, D
	PGS Project works	Written comments in the end of the report, graded with scores (from 50 to 85)

Primary 1 (Peter's classes)	PGS workbook	"✓" or "X" for each answer No written comment, graded with A, B, C, D
	PGS worksheet	"✓" or "X" for each answer Some written comments besides wrong answers, graded with A, B, C, D
	PGS Project works	Written comments in the end of the report , graded with scores (from 35 to 80)

7.2 Did students' works demonstrate inquiry-based learning?

By using the checklist (see appendix 3) designed according to the principles of Grotzer (1996) for successful output of inquiry-based learning at classroom, the students' works of the target schools show following features of inquiry-based learning.

For the principle (1) of the checklist *"the existence of experiential learning mediation from adult"*, the assignments of both school (A) and (B) indicate that experiential learning has been applied. Classroom and home-based inquiry activities could be found from the worksheets and project works. Such inquiry-based activities included science experiments (e.g. primary 4 worksheet of Henry's students, school A) and simple surveys (e.g. primary 5 worksheet of Alex's students, school B). Since the worksheets of school (B) were designed by the teachers and the content are mainly records of inquiry activities, the assignments of school (B) tend to demonstrate more "experiential learning" than that of school (A).

For principle (2) *"question asking is invited"*, there was no such thing as "inviting question asking" in the assignments. Usually, the questions were designed by teachers or the textbook publishers and students were guided to

find their answers.

For principle (3) *"mistakes are valued",* mistakes were treated directly by school (A) teachers with a "X" symbol. Students did their correction by writing the correct answers beside the wrong answers with ball pen to distinguish from the original answers which were written with pencil. Teachers of school (B) had different treatments to students' mistakes. They not only marked the answers with "✓ "or "X" but sometimes wrote comments beside the wrong answers (mainly in students' project reports and worksheets). Judging from the project reports, Alex put more comments than Peter did.

For principle (4) *"the existence of open-ended question"*, there were open-ended questions in the worksheets of both schools. However open-ended questions were marked differently in different schools. School (A) teachers tended to not comment on the answers of the open-ended questions while teachers from school (B) tended to comment the answers in detail. Phases like "*good works"*, "*try to think in this way...*", "*have you omitted some aspects?*" (Alex marked), "*good progress!*" (Peter marked) could be found in students' exercises books and group project reports of school (B), again, Alex gave more comments than Peter did.

For principle (5) *"more than one answer"* and principle (6) *"theorizing and evidence is considered important"*, as mentioned earlier, both schools (A) and (B) have designed open-ended questions in the assignments and hence we may say that they accept "*more than one answer*" principle but this principle does not apply to questions asking for facts and information. Further, it is difficult to tell whether teachers of school (A) consider theorizing and evidence more important than a right answer especially in the

project reports, since both Fanny did not give written comments on students' works and Henry gave a few only. In school (B), teachers usually gave comments on the evidence and information collected by students in their project works or information collection exercise, again Alex gave more such comments than Peter did.

Principle (7) *"the existence of non-answered question"* did not apply on the students' works of the target schools, since all questions have to be answered. For principle (8) *"all idea are welcome to share"*, it has been found that in some project reports of school (B), Alex commented positively on students' own ideas in concluding their project works. Other than that, there was no evidence showing that students' works were deliberately shared among students in both school (A) and (B)

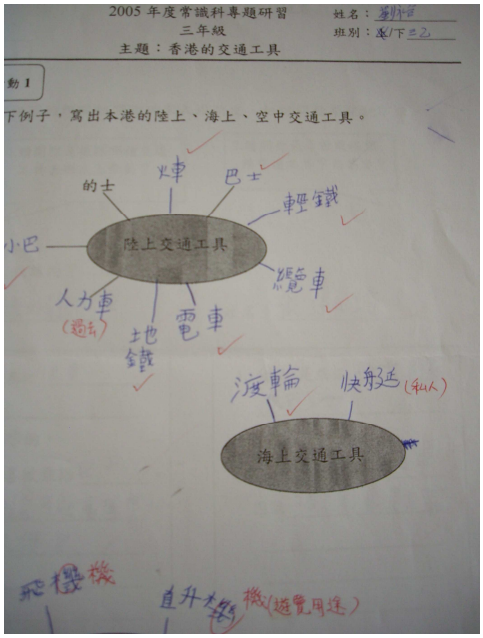
For the last principle *"ideas are discussed for their explanatory potential, and ability to solve the problem"*, the marking of school (B) students' works may have demonstrated such principle, because school (B) teachers did write comments on students' works. As mentioned, in school (B) Alex did better in this aspect than Peter did. On the other hand, the rigid marking of either "✓ "or "X" (in worksheets, workbook and project reports) by the teachers in school (A) may imply the opposite direction that no discussion existed between teachers and students in doing the assignments (see picture 4 and 5).

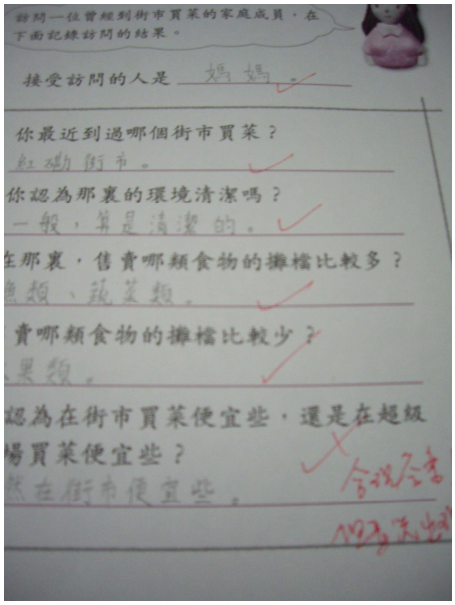
Thus, generally speaking, only some of the principles of Grotzer (1996) could be found in students' works of the target schools. The principles of experiential learning, open-ended questions (in both school A and school B) and the positive way in treating mistakes (in school B) were the three aspects that appeared more frequently. Obviously, the teachers of school (B)

demonstrated more inquiry-based features in their assignment than teachers of school (A) did.

Picture (7.1) Samples of the students' assignments of school B

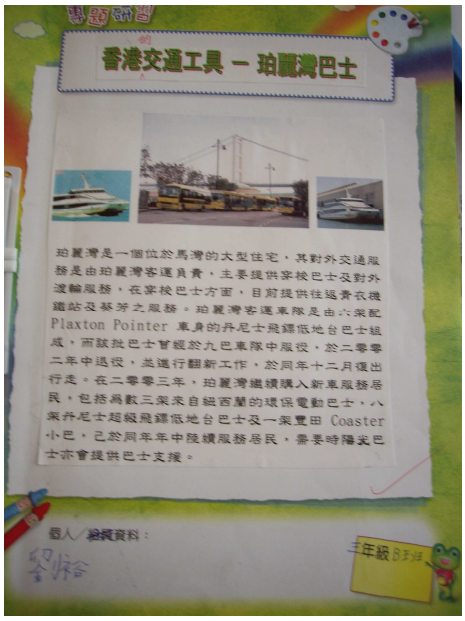
(Teachers not only marked the assignments but also wrote supplement or comment)





Picture (7.2) Samples of the students' assignments of school A

(Teachers only gave "✓" as feedback to the students' projects)



7.3 Teachers' beliefs as indicated in the students' work

Generally speaking, students' works of school (A) show that the selected teachers of school (A) may hold the core belief (Sigel, 1985) that "one right answer" is important for most of the assignments. Although we still found open-ended questions in the worksheets and workbooks, the quantity is much less than the close-ended questions asking for right answers. Coupled with the fact that teachers of school (A) did not comment the answers of the open-ended questions, it hence gave the researcher an impression that, teachers in school (A) concerned themselves with the giving of right answers to students. Although there were also inquiry orientated assignments like project works, one could still tell that, to the teachers in school (A), the product is much more important then the learning process. Because, teachers' marking criteria in project works were obviously based on the quantity of information collected and the length and of the written reports. Certainly it also reflects that teachers in school (A) may hold the belief about praxis that it is teacher's duty to give the right answer and final answer to students. Such a finding raises an immediate question that Henry of school (A) was found, in the initial interview, carrying positive belief towards inquiry-based learning and yet, almost no supporting evidence in this aspect could be found from the assignment he gave to his students and the way he marked the assignments.

On the other hand, the design of the assignments showed that, teachers in school (B) tend to pay more attention to the learning process, the generic skills and fostering of abilities of inquiry. For example, the teachers designed worksheets and group projects that need group effort to finish and teachers also gave comments on the process of doing such group works. Students

were also required to demonstrate self-regulated learning on the process of doing project. Students were encouraged to learn necessary skills in doing project learning according to their own pace and needs. Such doing of an assignment not only encouraged self-regulated learning, but also promoted inquiry skills especially in reflection and higher order thinking. Adding the relative open attitude in marking the assignments and giving concrete comments on students' assignments, it gave the researcher an impression that teachers in school (B) tend to have the belief about praxis that assessing students' ability and skills demonstrated in inquiry-based learning, is more important than assessing their knowledge only. It leads to a question about teacher Peter, as he demonstrated rather negative attitude towards inquiry-based learning, yet the assignment he delivered and the way he marked the assignments still show some inquiry-based features. Nevertheless, apart from some inquiry-based assignments; teachers in school (B) still delivered non-inquiry-based assignments to students. Factual recalling exercises (e.g. students fill in the blanks of the workbook by only copying the answers from the textbooks) were still playing a role. It may as well imply that although teachers in school (B) believe that inquiry-based learning could benefit students, they still hold the core belief that traditional rote learning is still important to students.

7.4 Comparison to the data collected by other tools

The findings from analyzing students' works, not only provided more background information for further study, it also acted as a source of confirmation and comparison for what have been found from other data collecting tools in phase one of this study. The following conclusions could

be reached by comparing these three steps of studies in phase one

Teachers' role and a right answer

It has been found from the initial interviews that, more teachers from school (A) showed disagreement on the role of teacher as facilitator in inquiry-based learning. Most of them (except teacher Henry) were reluctant to accept the point that "inquiry process is more important than to find the right answer". In these two aspects, one could find further evidence from the students' works of school (A). As mentioned before, teachers from school (A) tend to mark the assignment with a rigid "right" or "wrong" criteria, and they seldom gave comment on students' answers. It implies that teachers in school (A) tend to believe that it is teacher's role to give the final judgment on students' answers and there is only one right answer for each question. Although they still prepared open-ended questions, they seldom comment on the answers of those open-ended questions. It transmitted a meaning to the researcher that teachers of school (A) only took those questions and answers lightly, as something ad hoc on the formal lessons or as an opportunity for students to express their opinion only.

On the other hand, although it was revealed in the initial interviews that not all teachers in school (B) showed positive attitude towards the principles of *"teacher as facilitator"* and *"inquiry is not about seeking a right answer"*. The design of students' assignments and the marking criteria for those assignments show that even teacher Peter has followed some of the direction of inquiry-based learning in treating students' assignments. It echoes the finding from the school document that the PGS panel is an effective agent in bringing change in teachers' behaviour, especially in employing inquiry approach.

The challenge of assessment

It has also been found in the initial interviews that assessment is a major challenge to inquiry-based learning. According to Sadler (1989) and Harlen (1997) formative assessment is essential to inquiry teaching but in order to be useful, formative assessment must cover the important outcomes that are intended in inquiry learning. That is, it must be concerned with the process skills. The analysis of schools' documents also reveals that it is a policy in both school (A) and (B) to maintain both formative assessment and traditional summative assessment. Nevertheless, the assignments of school (A) show that the formative assessment was only in the form of coursework (in fact it is still for grading but not facilitating learning) it is an administrative measure rather than something with much learning value. The formative assessments were broken down into pieces of worksheets but there was not strong relationship among different pieces of assessments. In other words, there was not systematic formative assessment in school (A). The assessments content, as revealed from students' works, was focused on knowledge rather than process, skill and ability. It gave the researcher an impression that assessing knowledge dominated the assessment policy of school (A).

On the other hand, in school (B), the formative assessment is in the form of worksheets and project works and they were in a more systematic manner. However, the assessing of fact recalling or the content of the textbook still plays a role in school (B). It may be because students have to take standardized tests and teachers still need rote learning exercise to prepare the students.

The use of IT

It has been mentioned by teachers from the two target schools that they used IT as the major instrument to assist students' inquiry-based learning. It was also found in schools' documents that both school (A) and (B) prepared list of IT resources for teachers and students. One of the proofs in this aspect may be the report booklet and some CD ROMs attached in the reports of group projects. According to the label of these CD ROMs, most of them were "power point" files for presentation of the project findings.

Non science content

Teachers from school (B) appeared to suggest in the initial interviews that they might have dominated the inquiry-based activities with science investigation while subject content such as social, historical, personal growth were seemed to be excluded from the inquiry-based methods. Students' works in those neglected areas should provide information on the real situation. Looking at the school-based project woks of school (B), it did not confirm the inference. Themes and inquiry tasks in areas beyond science were also designed according to inquiry approach. Assignments like interviewing, observation and surveying were the common activities used for non-science content, especially for senior primary students.

Junior level students

It is not a surprise to find that the students' works of junior level look less inquiry-orientated. The situation was found both in Fanny's students of school (A) and Peter's students of school (B), although the issue of junior level students was raised by teacher Peter. It was explained by relevant teachers that it is the consideration of junior students' ability to adjust the inquiry level of the assignment. For example, the project learning is adjusted

to information collection exercise only for junior level student in school (B).

Did teachers follow school policies?

By only examining students' assignments, one could say that teachers of school (A) followed some of the school polices as prescribed in the PGS handbook of school (A). Some of the instructions about students' assessment mentioned in the handbook (PGS handbook of school A) were adopted. The handbook prescribed the following criteria for PGS assignment.

1. *Teachers should deliver productive assignment according to students' abilities.* (p.7)

The worksheets of school (A) were divided by level of difficulty, although it could be seen that the worksheets were designed by the textbook publisher.

2. *Teachers should give assignment that could strengthen knowledge acquired at lessons.* (p.7)

As mentioned, the workbook and worksheets were mainly knowledge based.

3. *Parents are encouraged to involve in students' homework therefore teachers should design assignment that involve parents. (p.7)*

Some of the questions appearing in worksheets require parents to provide information on their children's home-based assignments (e.g. the confirmation from parents on children keeping pets). However, the school has also instructed teachers to design a wide variety of assignments for students and to put students at the center of learning (p.8), the content of the assignments of school (A) did not fully reflect such directions, since the assignments were limited to workbooks, worksheets and project reports, the

variety could not be described as wide. Further, the school's handbook also reminds that the assignments should be in conformity with the inquiry-based principles (p.7), and yet students' works were still mainly facts and knowledge recalling exercises, to which students were expected to find out the answers from textbooks only. The only exception was the project work reports, inside these reports students were allowed to have their own opinion and conclusion.

In school (B), students' assignments reflect that teachers were trying to fulfill what they have discussed at the meetings, even though the school administration did not delineate specific policy on PGS assignment. According to the meeting minutes, all criteria and content for students' works were discussed and decided by PGS teachers. For example, it was discussed at the meeting of January 2006 that students of senior level should learn to write reflective comments on their own project works and it was also concluded at the meeting of Sept 2007 that teachers should give detail feedback to students' home works. The result was actually reflected in the project report books, workbooks and worksheets presented before the researcher.

7.5 Summary of the analysis of students' works

Apart from providing information on resolving the queries aroused from previous data collecting procedures (the initial interview and the analysis of school documents), the analysis of students' works also generated following results.

1. Students' works of both school (A) and (B) demonstrate some features of the effective inquiry-based learning as suggested by Grotzer (1996).

Yet, comparatively speaking, students' works of school (B) seems to demonstrate more inquiry-based elements than that of school (A). The marking of assignment by teachers of school (B) also tend to show a higher level of interaction between teachers and students, which is essential for teachers to act as facilitators instead of knowledge transmitters.

2. However, a closer look into the content of students' assignments revealed that there was still a certain amount of ingredient carrying non-inquiry features. As mentioned, rote learning or fact recalling exercises and questions still occupied a major portion of the assignments in both school (A) and (B). Besides the requirement of the examination, another reason may be the reliance of textbook and materials prepared by textbook publishers. The PGS textbooks used by the target schools are mainly content base; they are more like reading materials rather than guideline for inquiry-based activities. Further, the workbooks and worksheets prepared by the textbook publishers are mainly designed to gear with the content of the textbook. Therefore, relying on those materials means restricting students' inquiry to the pre-designed content of the textbook.
3. The assignments teachers delivered and the style of marking on these assignments did not completely confirm teachers' beliefs as indicated in the initial interviews. Henry of school (A) and Peter of school (B) both was found contradictory results when comparing their interview answers and the students' assignment they taught.
4. Only some of the school policies on students' assignments were implemented by teachers of school (A), while most of the principles

discussed by teachers of school (B) (as found from the meeting minutes) were demonstrated in student's works of school (B) teachers.

5. Overall speaking, it reflected that teachers still faced a dilemma in fully adopting the inquiry-based approach, especially in promoting higher order questions and open-ended questions.

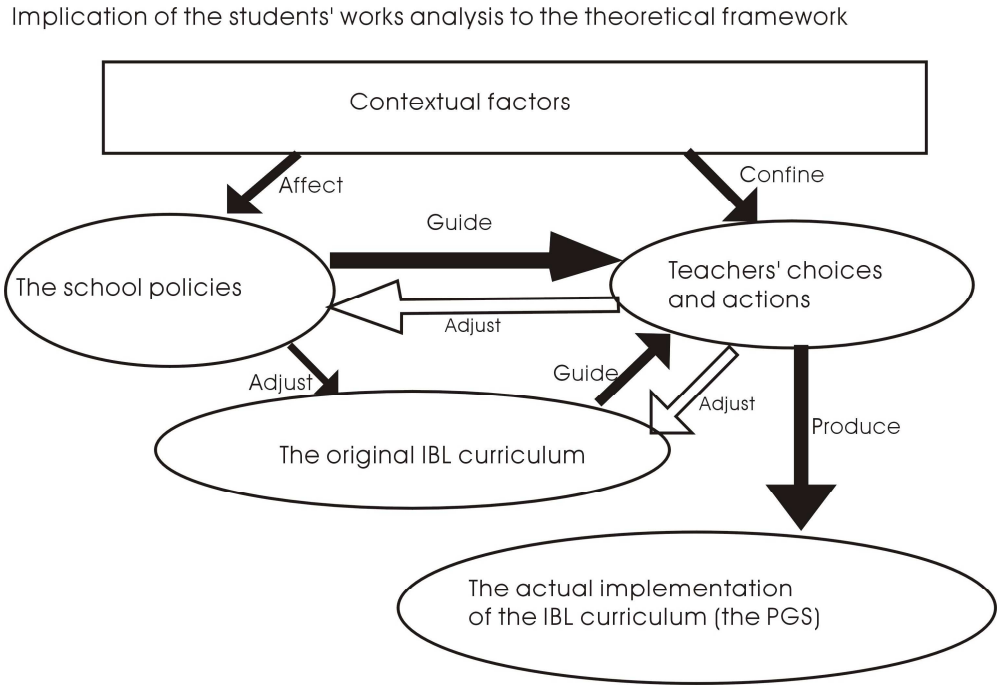
7.6 Implication to the theoretical framework

The divergence between school policy and teachers' actions as expressed in students' works implies a phenomenon that although the administration of school (A) has instructed all the rules and criteria for designing assignments, through issuing a handbook, only some of the instructions were observed by the teachers. On the contrary, in school (B) the principles for designing and marking assignments were discussed and designed by all the teachers inside the panel. Following that, almost all teachers followed the principles set up at the panel meetings. Hence, the examination of the students' works reflects that, in school (A), there was greater deviation between the school policies and the teacher's actions, especially in the handling of the assignments.

Referring to Sigel's (1985) components of beliefs, the contextual influence on belief formation and practice was demonstrated through the influence in the assignment policy in leading teachers to believe that rote learning materials and fact recalling exercise still play a role, even in an inquiry-based curriculum. As O'Loughlin (1986) explained Sigel's contextual component that one of the hidden factor that influencing teachers' belief and action is the pre-packaged worksheet and standardized test. In this study, both pre-designed workbooks (designed by textbook

publishers) and standardized tests were adopted in the two target schools. Such materials are mainly fact recalling exercises and thus it implies that teachers from both schools were affected by such a design of exercises. Although there is a difference in the way the policies and principles in student's assignment were designed, both school (A) and school (B) have adjusted the official requirements for the PGS in student's assignment or assessment. Both schools have included rote learning and fact recalling exercises. For school (A) the school handbook instructed teachers to design exercises that can strengthen the facts learnt at lesson (p.7). In school (B) teachers discussed and decided to retain a major portion of marks allocated to the summative assessment (test and examination). The situation is showed in figure (7.1).

Figure (7.1) Implication of the students' works analysis to the theoretical framework.



7.7 Questions emerged from the students' works analysis

The analysis of students' works has alerted the researcher with a series of new question. First, "what will be the true picture of teachers' assessment of students at lessons?" Since students' works of school (A) reflected very little teachers' feedback to students answers, it will be important to see whether teachers give verbal feedback to students at lessons, especially teachers of school (A). Second, the findings about Henry and Peter have already raised a question for their contradictory actions as comparing to their answers in the initial interview. Certainly, these new questions would be addressed in the lesson observation process in phase two of this study.

Chapter 8

Phase two: Report of the lesson observation

8.1 The purpose and function of the lesson observation

Tilstone, (1998) defined observation as:

> *The systematic, and as accurate as possible, collection of usually visual evidence, leading to informed judgments and to necessary changes to accepted practices.* (p.6)

Zhang (2003) commented on observation as a research technique or method which implies several features:

(a) The collection of evidence

(b) The examination or analysis of the evidence, and

(c) The formation of significant judgments based on the evidence and the subsequent implications

The lesson observations arranged in this study was aimed at finding the authentic situation in PGS lessons of the target schools, especially, the impacts of teachers' beliefs in implementing inquiry-based learning. Besides, the researcher also relied on the observation to answer questions that emerged from the initial interviews, documentary analysis and analysis of students' works of the target schools.

8.2 The administration of the observation

Before the commencement of the observation, a checklist was prepared and pilot tested (see appendix 4). Montgomery (2002) believed that the

checklist as an instrument is commonly used by most types of observation and a good checklist will provide observation with a helpful proposed sampling frame which "*established on the basis of experience in classrooms and discussion*" (Montgomery, 2002, p.39). The design of the checklist for this study has considered the characteristics of an inquiry-based classroom, as suggested by Falk & Drayton (2001) and the effective teaching behaviour for inquiry-based learning suggested in Exline (1995).

The schools administrators of the target schools arranged the researcher to observe two PGS lessons at their schools. The teachers being observed were selected from the initial interviews in which two teachers from each school were identified. These teachers had demonstrated different standpoints in inquiry-based learning; or in other words, they had the greatest variation of beliefs towards the basic principles of inquiry-based learning. The selected teachers were Henry and Fanny of school (A) and Alex and Peter of school (B).

In order to observe the daily practice of the teachers and the usual performance of the students but not exhibitions, the school principals promised that they would not inform the relevant teachers and classes until the morning that the researcher came. Besides, for making sure that the observed lessons were not exceptions, the observed lessons were basically selected randomly.

The researcher picked two random Wednesday and asked for the permission for observation. In one Wednesday, Henry taught a lesson to primary four students (about 9-10 years old) on the topic of "the investigation of water" while teacher Fanny taught primary six students (about 11-12 years old) a lesson about "the emergency services in Hong

Kong". Both lessons were double lessons each lasted for 70 minutes (from 8:55am-10:05am). The lessons were delivered in normal classrooms (see picture 8.1). On another random Wednesday, Alex and Peter of school (B) were observed. Alex taught lessons about Chinese culture and Peter taught inter-personal relationship respectively.

The researcher sat aside at the rear corner of the classrooms and tried his best to be a non-participant in the lesson, although it is not possible to eliminate the effect of the presence of the observer. Checklist and note pad were used but not any electronic recording facilities. It was because one of the school principal requested the researcher not to record any content of the lessons with electronic or digital device. Hence, for the purpose of fairness and reliability, the researcher used the primitive tools to record the lessons for both schools; that means pencils and paper. Taking the advice of Sanger (1996), who believed that observation can be made "*by looking at the collected evidence and seeking to discriminate the significant from the insignificant within that evidence"* (p.22), the researcher observed those significant aspects of the lessons with the checklist and yet he noted any thing which was valuable but not on the list.

8.3 Result of observing Henry of school (A)

Henry is a male teacher of 25 to 30 years of age. He was selected because of his supportive attitude for inquiry-based learning as expressed in the initial interview. His belief situated at the right hand side of the continuum in figure (5.1). That means he claimed that teacher should only provide an environment which foster students' inquiry without giving them too much instruction, he almost completely agreed on the statement

extracted from the PGS Guide; *"teachers is the facilitator"*. However, no obvious evidence of inquiry-based assignments was found from the students' works he gave and the way he marked the works. The following paragraphs describe how he and his students performed in a PGS lesson.

1. The environment of the classroom

   The lesson was delivered to a class of primary four students (about 9 to 10 years old) in a standard classroom. Facilities include a computer and a projector. There were 32 students in the class and it was a relatively small class comparing to normal class size in Hong Kong, which is usually over 35 students. Students sat in rows with 5 to 6 students in each row. Picture (8.1) is a reference for such type of classroom.

Picture (8.1) A typical classroom in a primary school of Hong Kong

2. The content of the lesson

   The topic of the unit being taught was "the inquiry of water". It was the second lesson of the unit. In the first lesson, students had already learnt about the three states of water (i.e. liquid, solid and gas). In this lesson, the teacher aimed to help students to inquire into the floating and sinking nature of different objects in water. The teacher started the

lesson with questions asking the content learnt in the last lesson. Then the teacher asked students about the experience in daily life. Questions like "*Have you seen this situation*?" and "*Have you ever thought about…*?" were usually asked. The teacher then led a matching game to which students inferred which object will float and which will sink with an experiment in a box (plastic box) of water. Most of the time the answers were provided by students, the teacher supplemented necessary information and clarified misconceptions only after students had reflected their own thinking and experience. After that, the teacher assigned students to form groups to discuss and design experiment to test the shapes of the object, which help the object floats in the water. Finally, the teacher helped the students to conclude the findings of the inquiry activities. Then he reminded the students to record their findings and draw references from the textbook.

3. <u>The atmosphere of the classroom</u>

   Generally speaking, the students were disciplined and yet proactive in learning. There was noise throughout the lesson but it was mainly the working noise and the level was acceptable. Teachers showed enthusiasm in delivering the lesson while students responded with excitement and curiosity. Teacher and students were co-operative and it could be seen that such a co-operative norm has been built long before the lesson being observed.

4 <u>The features of inquiry-based learning</u>

   By using the checklist (see appendix 4) modified from theories of Drayton & Falk (2001) and Exline (2004), the observer found that among the 17 features in the checklist, 9 features were detected. They

either appeared frequently or occasionally.

- *"Inquiry is in the form of authentic (real-life) problems within the context of the curriculum and/or community"* (Item1) was demonstrated as the lesson was about real-life observation of students for something floating in the water while they had also seen something sink in the water. Such a topic was extracted from the section of "science and technology in daily life", a strand of the PGS curriculum.
- *"The inquiry capitalizes on student's curiosity"* (Item 2) was noticed as the students always showed curiosity through their enthusiasm and excited expression in answering teachers' questions and doing the experiments.
- *"Teachers and students always collaborated"*(Item 4) was also detected especially in the experiment of "*what kind of shape would help objects float?*" teacher invited students to discuss in groups and made an object with plastic clay that would float in water. Students made the objects and teachers acted as the referee; he added coins on the objects and tested how many coins the objects could carry before it sank. During this activity, students took ownership of their learning, because when some students' products failed to float in the water, the teacher did not comment on the reason, rather, he challenged the students to discuss among group members and tried to solve the problem.
- *"The teacher frequently modelled the behaviour of the inquirer"* (Item 6) was also seen as the teacher posed challenges and questions with language of inquiry to students when they discussed and did

experiments in groups. The teacher always said, *"Do you really think that?*" "*Do all of you agree?"* and *"How to prove that?"*

- *"The teacher used technology to advance inquiry"* (Item 10) was occasionally detected. Before students started to discuss the experiment, the teacher provided stimulation by using a power point presentation projected through computer and projector. It helped students to focus on significant aspect of the problem about "float and sink", especially about the material and shape of the objects that float or sink in water.
- *"The teacher and students interact more frequently and more actively than during traditional teaching"* (Item 12) has also been found in the observation that teacher-student interaction was much more frequent than that of a traditional lesson. About 70-80% of time was allocated to inquiry-based activities as comparing to the traditional non-inquiry PGS lesson, which is mainly an explanation of the textbook content by teacher.
- *"Identifiable time for inquiry-based learning"* (Item 13) was surely fulfilled. About 70% of the lesson time was allocated for inquiry-based activities.
- *"The teacher asks questions, encouraging divergent thinking that leads to more questions"* (Item 14) could also be seen as the teacher always asked questions yet such questions did not necessary lead to divergent thinking but rather, prompting questions or assisting questions for students to finish the inquiry.
- *"The teacher occasionally clarified the misconception of students"* (Item 15) was noticed as the teacher occasionally challenged

students' suppositions in experiments. For instance, when one group of students concluded, *"things which are heavy will sink in the water"*, the teacher challenged these students by asking *"what about a big ship in the sea, is it a heavy thing?"* Then he invited the group of students to do an experiment by making a boat-shape object with plastic clay.

Overall, Henry demonstrated an effective inquiry-based lesson although he had not fulfilled all the features of the checklist, he has taken care of most of the major features and he did not do anything that would hinder the motivation of students to inquire.

5. Questions emerged

In general, students of this class behaved very well. They were cooperative, proactive and obedient. It raised an interesting question that how the teacher kept students with proactive attitude and at the same time made them observe the class rules and teachers' instruction. The questions will be asked in the follow-up interview.

8.4 Result of observing Fanny of school (A)

Fanny is a female teacher of 35 to 40 years old. She was selected because she showed relative negative belief towards inquiry-based learning. Her position was situated at the left hand side of the continuum in figure (5.1), as she asserted that a teacher should provide enough instruction and background information before asking student to do any inquiry and she disagreed on the statements *"teacher is a facilitator"* and *"inquiry is not about seeking the right answer"*. The following paragraphs describe how she and her students performed in a PGS lesson.

1. The environment of the classroom

   Her lesson was delivered to a class of primary six students (about 11 to 12 years old) in a normal classroom with standard equipment. There were 35 students in the class. Students sat in 6 rows (each have 6 to 7 students) except at the time of group discussion, at that period, students sat as groups by moving their desks and chairs. The lesson was a double lesson lasting for 70minutes (from 11:00am-12:10pm).

2. The content of the lesson

   The topic of the lesson was "the emergency services in Hong Kong". It was the first lesson of the unit. In the beginning of the lesson, the teacher spent about 20 minutes lecturing on the meaning and types of emergency services in Hong Kong. Afterward, she started to discuss with students their experience in using emergency services. The discussion lasted for about 15 minutes and then the teacher asked students to form groups and she distributed one worksheet to each group for recording the discussion. There was one case study in the worksheet. The case described a boy who was hit by a car when he crossed the road. The worksheet asked students to discuss the case where a student passed by the accident site, what kind of action he should take. The teacher added, "*If you call the emergency services through your mobile phone, what would you say? What kind of information will you give to the policeman?"* After 15 minutes of discussion, students were asked to report their answers. After that, the teacher selected three groups to do role-plays for the case being discussed. Finally, the teacher asked students to drop down the answers the teacher put on the black board then she concluded the lesson by

using the electronic books projected on the screen of the classroom.

3 The atmosphere of the classroom

In the first 20 minutes, the class was very noisy. The students were chatting among themselves during the lecturing section. At the beginning, the teacher tried to use her own voice to control the situation by shouting many times for silence and co-operation. However, the situation has not improved then she took out her personal amplifier and the volume of her voice increased immediately. The situation was under control after the teacher used her amplifier and expressed an unhappy face.

When the lesson proceeded to the group discussion activity, the noisy situation appeared again. The time for grouping and moving desks and chairs occupied almost 5 minutes. When the students settled down for discussion, the researcher tried to walk closer to the groups and listen to their discussions. The researcher found that two or three groups used about one third of the time discussing matters that were irrelevant to the assigned topic. The noisy situation lasted for about 15minutes (the discussion lasted for 10 minutes). The teacher had to raise her voice again by using the amplifier to clam down the class. During the report and role-play sections the class was filled with happy laughing. It was noisy and the researcher observed that students were enjoying the laughable things that happened in the role-plays, instead of paying attention to the content of learning.

4 The features of inquiry-based learning

By using the checklist, the observer found three features which might favour the development of inquiry-based learning.

- The lesson was about real-life problems within the context of the curriculum (Item 1 of the checklist), because it was about the proper using of emergency services, which is practical to daily life, and it was inside the PGS curriculum.
- The inquiry content "how and when to use the emergency services" was always community and social connected (Item 5 of the checklist).
- The teacher occasionally adopted some inquiry-based teaching approaches (Item 11) by using group discussion and role-play at the lesson.

However, in that lesson, most of the important indicators of an inquiry-based lesson inside the checklist were missing. For examples, the teacher had not encouraged thinking and she seldom asked student open-ended or higher order question. There was no evidence that she valued students' point of view, because she always gave the model answers without providing feedback to students' answers. Overall, the time and opportunity allowed for inquiry-based learning only occupied about one third of the teaching time. The other two third of time was allocated to lecturing and instruction. Besides, even during the discussion section, the teacher did not use language of inquiry on an ongoing basis. The statements that appeared most frequently were *"Have you done that?" "Have you filled in the answer yet?" "Keep quiet!"* Therefore, comparing to Henry in the same school, the lesson of Fanny was at a lower level of inquiry. In fact, the lesson was not much different from a traditional PGS lesson in which teacher did most of the talking.

5. Questions emerged

It was a little surprise to the researcher that the class was quite noisy and inattentive throughout the lesson. The point the researcher was concerned about most was that the teacher seemed to have adopted some teaching strategies that should have facilitated inquiry-based learning but the students showed very little intention to concentrate on their inquiry content and thus those strategies became ineffective. Further discussion is therefore needed to clarify that whether the situation observed was a special case or something that happens in everyday lessons. Besides, the researcher would also like to listen to the comment of the teacher on the quality of the lesson in her standard.

8.5 Result of observing Alex of school (B)

Alex of school B is a male teacher between 30 to 35 years old. He was identified in the initial interview as a typical supporter of inquiry-based learning. His position was at the right end of the continuum (figure 5.1). He expressed the view that teacher should create an environment that would foster students' inquiry instead of transmitting knowledge to them directly. He agreed on the statements *"teacher is the facilitator"* and *"inquiry is not bout seeking the right answer"*.

1. The environment of the classroom

Alex's lesson was delivered to a class of primary five students (about 10 to 11 years old) in a normal classroom with standard equipments. His class had 32 students. Students sat by 6 rows with 5 to 6 students in each row. For group discussions, students sat as groups by turning their bodies facing other members within the group without moving desk or

chair. The lesson being observed was a 35 minutes single lesson (from 10:05am-10:40am).

2. The content of the lesson

   The topic of the lesson was about Chinese culture "the story of tea". It was the first lesson of the unit about Chinese culture and tradition in primary five PGS curriculum. In the beginning of the lesson, the teacher spent about 10 minutes showing a power point presentation about various legends of the origin of Chinese tea. The presentation included the story of "Shen Loung", the personage who is regarded as the inventor of all Chinese herb medicines. After the power point presentation, the teacher discussed with the class their experience in consuming tea. The discussion lasted for about 5minutes. Then the teacher assigned a task for students. The teacher gave each group a note, which printed some information of specific type of Chinese tea. Each group got the information of one type of tea. Students were allocated 10 minutes to discuss and design a one-minute advertisement to promote that type of tea to foreigners. After the group discussion, students from different groups were invited to come out to present their advertisements. Because of the time limit, only 4 groups were actually invited.

3. The atmosphere of the lesson

   It gave the researcher an impression that the teacher-student co-operation was fluent and effective. Examples could be found when the teacher finished the power point presentation; one student came out to switch on the light of the classroom while another student came out to lift up the screen that was covering the black board. Their actions

were swift and proactive. Besides, when the teacher told the class to start group discussion, group leaders came out by themselves to collect their information and group members turned their bodies facing each other simultaneously without any instruction or reminder. It seemed that the students knew very well the routine of the lesson.

Furthermore, the general atmosphere of the classroom was quite active. Naturally, there was some noise all the time, but when the teacher began to speak; all students stopped talking and paid attention to the teacher even during group discussion. It gave the researcher an impression that all students were eager to learn and willing to be cooperative.

4 The features of inquiry-based learning

This lesson demonstrated 10 characteristics of an inquiry-based lesson according to the checklist.

- Although the lesson was about a cultural theme on the topic of "the story of tea", the teacher led the lesson to authentic experience of students especially in their experience of tasting Chinese tea. In fact, the inquiry is an important one for Chinese students since drinking tea is part of their daily life (Item 1 of the checklist).
- Students always showed interest and curiosity (Item 2) in knowing the origin of discovery and processing of Chinese tea and the interesting way to promote Chinese tea.
- The information about Chinese tea has been interpreted, digested and discussed (Item 3), both during the introduction of the teacher and in the group discussion.
- Teacher-student interaction and collaboration were obvious and

healthy (Item 4) as shown in their operation of the class routine and inquiry routine.

- The teacher used inquiry language frequently (Item 7). Phrases like *"Think openly!" "Tell me why you think so"* and *"Persuade me!"* were used all the time and he encouraged students to think and think over from different angles.
- Students did take their ownership in learning (Item 8) during the lesson. Although the teacher provided a power point presentation and some information for discussion, the teacher did it for motivation of learning rather than transmitting knowledge directly. Further, the purpose of the information was not for recalling but for arousing students' interest in designing an advertisement in which creativity is the major objective.
- The teacher used technology to advance the inquiry (Item 10) by showing the power point as stimulation.
- Although the lesson only lasted for 35 minutes, about 25 minutes of the lesson was allocated to inquiry-based activities (Item 13).
- The teacher encouraged responses and he posed new questions (Item 14). For instance, during the discussion, the teacher went to one group of students and listened carefully what they discussed, the researcher noticed that the teacher encouraged all the four students to give their opinion and thoughts. When the students finished sharing their ideas the teacher posed questions relevant to students' ideas, which were about the role-play of a news journalist.
- The teachers always asked students "*why*" "*How do you know*" types of questions (Item 17).

Therefore, the lesson led by Alex could be described as a highly inquiry-based lesson. Besides the features mentioned, it is most important to say that the teacher played as a learning facilitator, instead of only delivering some inquiry activities. It was the language he used, the way he stimulated students and the way he treated the learning materials that made the lesson highly inquiry-based.

5. Questions emerged

The topic taught in this lesson was mainly a cultural and historical one. It aroused the researcher's interest to know the way the teacher managed to make the lesson an inquiry one. The activity of designing an advertisement to promote Chinese Tea was a creative idea. The teacher was asked to share his experience and rationale to develop such activities in the follow-up interview. Further, it was also worth investigating how the teacher-student cooperation reached such fluency.

8.6 Result of observing Peter of school (B)

Peter of school (B) is about 45 to 50 years old. He was the one who was holding reservation on the feasibility of applying such approach to junior level students. His belief was situated at the left hand side of the continuum (figure 5.1). He admitted that teachers have to provide suitable instruction and guidance for students before asking students to engage in any inquiry. He disagree on the principles of *"teacher is the facilitator"* and *"inquiry is not about seeking the right answer"* as applied on junior level students.

1 The environment of the classroom

The lesson was delivered to a class of primary two students (about 7 to

8 years old) in a normal classroom with standard equipment. There were 25 students. They sat by groups of four. Desks and chairs had already arranged as group pattern. The lesson being observed was also a 35 minutes single lesson (from 12:10pm-12:45pm).

2. The content of the lesson

The lesson being observed was about inter-personal relationships with the topic of "making friends". It was the second lesson of the unit about building healthy inter-personal relationships and it is inside the strand of "personal growth and health" of the PGS Guide. The first lesson was the introduction of the concept of "friend". In this lesson, the aims and objectives were mainly helping students to develop life skill in making friends. In the beginning of the lesson, the teacher spent about 5 minutes to settle down the over excited young children. After the discipline action, the teacher started to remind students with the content of last lesson. He asked students the meaning of "friend" and some student shouted out the answers. After the revision, the teacher began to motivate students' interest by discussing with them how they made new friends. He asked two students to stand up and demonstrate how to open the conversation in making new friend. Other students were so excited that they moved their bodies around and made noise in order to attract teacher's attention, hoping that the teacher would choose them to play the roles. The teacher had to settle down the students again by asking all students to stand up. He arranged for the students to sit down one by one according to their attitude in keeping silence. It took about 5 minutes until all students kept quiet and sat down properly.

Afterward, the teacher gave each group a note on which was printed

two simple lines of words describing two cases. The first one was about a child's father who lost his job. The second case was about one classmate who was sick and was absent from school. Students were asked to discuss the words they should use in order to show a friendly attitude and sympathy to the children in the cases. The teacher did not ask the students to write down their conclusion, rather he only asked them to discuss and report verbally. After 10 minutes, students were asked to report what they have discussed. When some students were reporting, other students made noise to interrupt the presentation. Such a situation happened frequently, and the teacher had to discipline the students repeatedly. When the groups finished reporting their answers, the teacher asked students to open the textbook and study the content inside. At that time, students showed boredom and moving their bodies around.

3. <u>The atmosphere of the lesson</u>

The most obvious impression given to the researcher was that both the teacher and students were struggling to lead the lesson in the direction they wanted. On teacher's side, he aimed at guiding the students to work in groups, to listen attentively and to follow each step of the inquiry process. However, on the students' side, they wanted to have fun, to talk about the matters they were interested in, and to move around to see what other groups were doing. Therefore, the teacher had to interrupt the lesson to handle discipline problems many times. It became a cycle that when the teacher talked, the students showed impatience even though they have tried their best to keep their mouths shut; then when the teacher allowed students to discuss in group,

students took the chance to talk about whatever they wanted to talk. Students took the time for inquiry as a time to relax and a time free from bondage. Most of them were not attracted by the content of the lesson. The same situation also appeared in the report section during the group discussion. When one group of students were reporting their conclusions, students in other groups were still engaging in chatting and moving around instead of paying attention to the reports, hence the report section became a very noisy and confused section of the lesson.

4 The features of inquiry-based learning

It was noticed in the lesson that the teacher did put effort in making the lesson looks inquiry-orientated. The following 3 features have been observed.

- The lesson was about a real-life problem (Item 1 of the checklist); how to make friend and dealing with friends.
- The teacher occasionally interpreted the information and help students to digest and discuss the information (Item 3) although the result was disappointing.
- The teacher always tried to model the behaviour of the inquirer (Item 6), and yet other irrelevant matters attracted the young students.

On the other hand, there were 5 features in the lesson which pointed to the opposite direction against inquiry-based learning.

- The teacher and students were not collaborating; rather they were competing for the control over the class.
- The teacher did not use language of inquiry; rather he had to use language of discipline and authority.

- The students did try to take the ownership of their learning but in various directions they wanted.
- Teacher-student interaction has increased but not in a productive way. The interaction was mainly for handling discipline problems.
- Although the teacher had prepared to use half of the lesson time on inquiry–based activities, the students took the time to do things other than productive inquiry.

5. Questions emerged

It could be seen in the lesson that the teacher faced great difficulty in delivering the inquiry-based curriculum to this class of students. However, the teacher still tried very hard to overcome the problems although there was still long way to go. Therefore, it was meaningful to have the teacher to express his feeling and thought towards such a challenge in the follow-up interview. It has been showed in the initial interview that the teacher held reservation in applying such concept to junior primary students. Has such belief any relationship to the performance of the students? Do other factors lead to the behaviour problems of the students rather than the inquiry-based arrangement? These were the questions to be clarified in the follow-up interview.

8. 7 Responds to the phase one of the study

During the phase one of this study, the initial interviews, the analysis of schools' document and students' works have generated some questions or focuses for further investigation. The result of the lesson observations provided useful information for these focuses.

8.7.1 Teacher's role and a right answer

It has been analyzed in phase one that teachers being studied held different beliefs in teachers' role in inquiry-based learning and some of them disagreed on the principle of *"teacher is the facilitator"* and "*inquiry is not about seeking the right answer".* The variation of beliefs has been illustrated in figure (5.1).

During the observation, teachers were performing roles approximately matching their beliefs as showed in the continuum of figure (5.1). Henry of school (A) and Alex of school (B) performed as facilitators for students' learning, although there was still variation in their actual practices. One common exception was that they provided certain amount of background information and instruction in the lessons; in addition to the stimulation and activities for students to inquire their knowledge. Further clarification was therefore needed in the follow-up interviews.

On the contrary, Fanny of school (A) demonstrated a comparative conservative role in leading the lesson. Although she prepared group discussion and presentation for students, it was the language she used and the instruction she gave that limited the thinking and inquiry of her students. It was in conformity with what she declared in the initial interview as she insisted that inquiry-based learning could only be operated under ample instruction and background information. Peter of school (B) held similar reservation towards inquiry-based learning, especially in the application on primary students. However, the observation showed that Peter tried very hard to overcome the challenge. It gave the researcher an impression that unlike Fanny, Peter showed willingness to try out inquiry-based approach in spite of the fact that he was constrained by the disciplinary problem of the

young students.

In the issue of *"inquiry is not about seeking the rights answer"*, Henry of school (A) demonstrated consistency to his belief that he did not comment on students with ultimately right answers; rather he encouraged students to try other possibilities especially in the experiment of float and sink in water. However, such attitude and doing were not manifested in the way he marked his student's works. The lesson of Alex of school (B) aimed at developing student's creativity, he prepared the activity of designing advertisement to promote Chinese tea, thus, no such thing as "a right answer" for this lesson. However, in the lesson of Peter of school (B) the teacher always gave final answers in the lesson "how to become a good friend of others?" although he also encouraged students to explore other possibilities for this question. Similarly, in the lesson of Fanny of school (A), the teacher insisted on only accepting the answers she prepared, even in the role play section, the teacher did not appreciate anything which was different from her model answers.

Therefore, it has been found from the observations, generally speaking, all teachers showed consistency in their teaching behaviour with their beliefs in inquiry-based learning as expressed in the initial interviews.

8.7.2 Using IT to assist inquiry-based learning

It has been found in the initial interviews that some teachers said that they relied very much on using IT to enhance inquiry-based learning and it had been decided to investigate the real situation at classrooms.

In the observed lessons, almost all teachers used computers and digital projectors to present their teachings except Peter of school (B). Henry of

school (A) used computer to show photos of large object that would float in water (i.e. ships and boats). His purpose was for stimulation of thinking and observation. Fanny of school (A) used the electronic book (the electronic version of textbook provided by the publisher) to explain the information about emergency services in Hong Kong. She used IT as the channel to present information and teaching content. Alex of school (B) showed a power point presentation on the legends of Chinese tea. He used it as stimulation, motivation and for transmitting background information. Finally, Peter of school (B) did not use the computer in the lesson but he had prepared printed notes, which were made with computer.

The researcher saw some significance for using IT in the lessons observed. Students were more attentive in watching power point presentation than listening to lectures of the teachers. Besides, the explanation of ideas and concepts was also clearer with the assistance of digital visual aids. However, in the observed lessons, there was not any occasion that students use computer by themselves to assist their own learning. IT was only used by teachers, in the observed lessons. It has been discovered from the school documents that the schools administrations have installed a list of IT resources which would help students' self regulated inquiry. Yet, during the observation, no evidence showed that students used these resources frequently or actively. Hence, further clarification is also needed in this aspect.

8.7.3 The problem of assessing students

Since the initial interviews, it has become a focus to examine the real situation of assessing students in an inquiry-based lesson. Teachers of the

target schools have stated that assessment has become a major challenge to them when they implemented the inquiry-based curriculum. It has also been found in the section of analysis of students' works that teachers of school (A) gave very little feedback on student's performance. Besides, it was also noticed that teachers from both schools emphasized a mixture of formative and summative assessment on students' learning; hence, it has been decided to observe the way teachers assess students and provide feedback on lessons.

It has been found in the observation that Henry of school (A) and Alex of school (B) tended to pay more attention to the process of assessing students' inquiries. They gave feedback and asked further questions when students were discussing and doing experiment. On the other hand, Fanny always reminded students to write down the conclusion or write down the bullet points the teacher put on the black board. She only provided the final answers to students without commenting the answers supplied by students. Even during the group discussion section, she only walked around and maintained the discipline instead of giving any feedback to students. It implies that Fanny cared about the final answers of the inquiry very much. Another teacher, Peter of school (B), did not show any effort for assessing students' inquiry process. He even told the students to discuss verbally only and not to write down anything. As mentioned, he was busy in handling discipline problems made by the junior level students during group discussion and reporting. Hence, it seems that he had no time and energy to assess the students and give feedback to students during the lesson. When students came out to report their discussions, he was busy maintaining the discipline of the audience and hence gave very little feedback to the report content of the students.

In sum, only casual assessments for students' inquiry were observed. However, systematic and consistent assessment scheme, especially those constructing a formative assessment, has not been detected. It may be because the teaching time is tight and the teachers have to take care of the teaching content, learning activities and classroom management, coupled with the number of students in a class, it is observable that some teachers manage to assess students' inquiry casually; some even did not try to do so.

8.7.4 Teaching time as a challenge

Beside assessment, target teachers also mentioned tight teaching schedules as the major challenge in the implementation of the inquiry-based curriculum. As we have discussed in the section of documentary analysis, the number of PGS lesson of the two selected schools were one lesson less comparing to the official recommendation. However, it is quite normal for the schools in Hong Kong to cut one to two PGS lessons and reallocate them to language subjects. Therefore, teachers have to finish a "five lessons curriculum" within three to four lessons in each week.

During the observation, all teachers handled their lessons with tight schedules. For example, they would only allow 5 to 10 minutes for group discussion and 10 to 20 minutes for reporting of the discussions. As one could imagine, inside a group, 4 students have to discuss within 5 minutes, means each student could only use about 1 minute to express his view and then no time is left for argument and responding argument. Besides, for some teachers who cared about the final "right answer" they even showed impatience to the so-called inquiry-based activities, they were eager to give the answers right away after issuing the questions. For those teachers who

really cared about the inquiry process, time was still a big obstacle to them. For example, in the lesson of Henry, he had prepared a power point presentation, class discussion, group discussion, class experiment and group experiment in the double lesson. Meanwhile, each activity consisted of a section of introduction and a section of conclusion. Nevertheless, he had to finish all these steps within 60 minutes, and allowed the last 10 minutes for students to refer to the textbook for consolidation. Hence, Henry and his students were moving very fast during the classroom.

Therefore, according to the situation observed, teaching time was really a great challenge for teacher to teach the new PGS, It was especially true for those who prepared inquiry-based learning seriously.

8.7.5 Non-science content

The literature review showed that the majority of studies on inquiry-based learning relate to science content. It has also been disclosed in the initial interviews that teachers who possessed positive belief towards inquiry-based learning usually obtained their experience from teaching of science inquiry (for example teachers of school B). Therefore, it has been a focus to look at the situation of inquiry-based learning in non-science content.

The researcher had watch at least one non-science PGS lesson for each school. In school (A) the lesson was about the emergency services in Hong Kong, a topic of social and civic strand, while in school (B), two lessons of non-science content were observed. They were a lesson about Chinese tea and a lesson about making friends respectively.

In the lessons observed, all teachers had adopted some inquiry-based

teaching strategies in their non-science PGS lessons. Activities like group discussion, role-plays and design of advertisement were used. However, teachers treated these activities differently. Alex of school (B) helped students to investigate the problem "what are the selling points of Chinese tea?" He encouraged students to study the information about tea and discuss with group mates to generate valuable points. He also asked students to infer the taste and needs of foreigners then formulate marketing strategies for selling Chinese tea to them. Therefore, it was a systematic process for inquiring a non-science topic. On the other hand, although Fanny of school (A) also adopted group discussion and role-play in her lesson, she treated them as individual activities only. She had not linked up the activities to the main theme of her lesson that was the proper way to use emergency services. Students' attention was even diverted from the theme to the cases being discussed. Although the students looked enjoying the role-play section, it gave the researcher an impression that the students were enjoying the fun they had for playing with classmates only, rather than learning concrete things from the activity.

Therefore, even in the lessons of non-science content, it still depends on teachers' attitude and behaviour to determine whether the lesson is inquiry-based or not.

8.7.6 The problem of junior level students

Peter of school (B) mentioned in his initial interview that in his experience, inquiry-based learning did not work with young children. Observing from his lesson, one may say that disciplinary problems created the major obstacle for implementation of inquiry-based learning with young

children. Yet, on the other hand, the overreaction of the teacher may have accentuated the problem as well. The teacher was busy handling discipline problems, keeping students in their seats and maintaining students' attention on the teaching content. Sometime he did it so hard that he neglected students' interest and motivation in learning. In fact, the researcher observed, it has become a cycle of discipline problem concerning this class of students. Because, when students were naughty, the teacher stopped the activities, then the students became bored and they thus created more trouble. Comparing to another class of the students in the same school, the class Alex taught, the situation was completely different. The problem would be followed up in the follow-up interview section.

8.8 The summary and implication to the theoretical framework

The section on lesson observation is a crucial part of this study. Most of the questions emerging from the studies of phase one, were responded in this section. More important, the lesson observation provided authentic reference for answering the basic research question "how teachers' beliefs affect the implementation of inquiry-based learning in the new PGS?" Some unclear problems have also been clarified by observing the real situation in lessons, that included the use of IT, the treatment of non-science content, the challenge of teaching time and more important, the actual situation of assessment. In summary, the lesson observations led to the following conclusions and implications for the theoretical framework (figure 8.1).

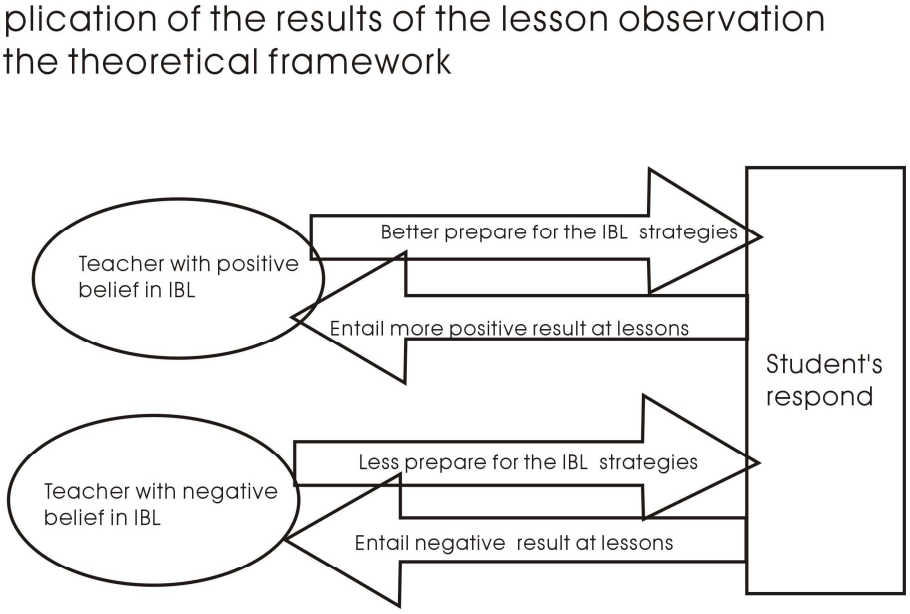
1. The result of the lesson observation basically matched the teachers' beliefs as revealed in the initial interviews.

2. Teachers who bore positive belief towards inquiry-based learning and tended to demonstrate more inquiry-based features in their lessons entailed better results at lessons. Such results included better cooperation from students, better student's concentration on inquiry process, more active inquiry of knowledge by students and more student-student interaction and collaboration. Similarly, teachers who carried less positive belief or even negative beliefs towards inquiry-based learning demonstrated less features of inquiry approach at their lessons also found less positive result at their lessons. Such negative results even included discipline problem, students focused on things other than the planned objectives and less student-student interaction and collaboration (see figure 8.1b).
3. The lesson observations provide further data for the components of belief (Sigel, 1985) of the observed teachers. Teachers' beliefs about praxis in handling an inquiry-based lesson were detected through the way they led the lessons. For example, Henry of school (A) and Alex of school (B) allowed their students to inquire the knowledge through group activities and experiments. It reflects that they believe that teachers should be facilitators only during students' inquiry process. On the contrary, Fanny of school (A) tried very hard to control the students to receive her pre-designed content, it implies that her beliefs about praxis include teacher should dominate the lesson and input knowledge into students, even in an inquiry-based subject. In the case of Peter of school (B), he had the major concern for students' discipline and such concern was well confirmed in the observed lesson. Hence, Peter's belief about praxis in "discipline come first", might has affected his

belief towards the practices of inquiry-based learning. In addition, the observed behaviour of the teachers also indicates the outcome of inquiry-based theory for teachers involved. Since Henry and Alex have generated more positive performance from students, they would surely perceive inquiry-based approach to be something effective. On the contrary, Fanny and Peter would conclude that inquiry-based learning does not work because they have seen the negative result in their lessons. Certainly, it is a cycle of cause and effect.

During the lesson observations, new questions also emerged, coupled with other areas that needed clarification, and the follow-up interviews were thus prepared.

Figure (8.1) Implication of the result of the lesson observation to the theoretical framework



IBL = Inquiry-based learning

Chapter 9

Phase two: Report of the data checking and the follow-up interviews

9.1 Purposes of the data checking and the follow-up interviews

According to the action plan of this study, follow-up interviews are delivered to the observed teachers after the lesson observations. Before that, the observation records with some preliminary interpretation prepared by the researcher were brought back to the teachers for checking. Teachers' comments about the records were made at the follow-up interviews. Unlike the initial interviews which were structured interviews with fixed questions, the follow-up interviews were loosely structured interviews with only broad areas for discussion with the teachers (see appendix 5).These areas included:

- the section for the teachers to comment the observation records,
- the section for teachers to express their feelings and
- the time for the researcher to clarify unclear areas and ask questions which emerged from the lesson observation and from the phrase one of the study.

The follow-up interviews were carried out about two weeks after the lesson observations. It took place after school and each section of the interview lasted for about 45 minutes. The following paragraphs report the results of these interviews.

9.2 Result of interviewing Henry of school (A)

Henry was observed in a lesson of primary four students in teaching

the topic of "the inquiry of water" with special focus on the "floating and sinking of objects". It has been noted from the lesson observation section that Henry delivered a successful lesson which demonstrated many features of inquiry-based learning and at the same time maintained the class discipline and student's interest.

9.2.1 Teacher's comments on the observation record

Henry described the lesson as effective in the sense that it fulfilled most of the aims and objectives he planned before the lesson. He agreed on the record (section 8.3) that the section showed the best result was the section of group experiments. It was beyond his expectation that students could think of so many different ways to design objects with plastic clay that would float in water. He also admired students' co-operation and obedience. He commented:

> *It may be because students found that the experiment was challenging and rewarding.*

He added that if the environment allowed, he would have required the students to do more experimenting including those designed by students themselves. He said that although students actively engaged in the activities, the experiments were designed by the teacher and the better way or the method suggested by the CDC guide includes the opportunities for students to identify the problems and design their own experiments to test their inference.

In addition to the recorded situation, Henry added the view that he was busy and a little bit nervous at the lesson. It was because, he only knew the

observation arrangement in that morning, and he did not have time to make any additional preparation. On the other hand, he still had to reserve some time for students to study the textbook and to summarize the important conclusions, although it was not the recommended procedure of the official guide. Nevertheless, he felt happy about the responses of the students. He said that although it was not the first time for him and the students to have a lesson which was full of activities and experiments, he saw improvement of the students both in thinking and co-operation within groups in that lesson.

9.2.2 The consistency between belief and action

The researcher asked that:

> *In the initial interview, you said that teacher should only provide an environment which fosters students' inquiry without giving them too much instruction. Do you think you acted according to your belief?*

Henry answered that:

> *As you have seen, I did give students some instructions and background knowledge. I have prepared the introduction section then I told them the steps for doing experiment…..I paid much attention to the stimulation and I think the stimulation for motivating students' interest and some necessary instruction on the operation of the experiment are essential. At the end of the lesson, I asked students to refer to the textbooks; my intention was to help them to relate their findings to the content of the textbooks, which will be used at the examination.*

The researcher asked the follow-up question

> *It reminded me the way you marked your students' assignments, you only provided them simple "✓" or "x" responds and it seems to deviate from the principles of inquiry teaching, Coupled with the point you just mentioned, does it mean that you were violating what you believed in*

inquiry-based learning?"

The teacher answered:

Not necessarily true, to me I believe in the principles of the PGS Guide that less instruction and guidance would be better but the actual situation is that…… I have to consider 3 other aspects besides just involving into the inquiry-based approach, they are parents' expectation, school's administration and practices of other colleagues. The point you mentioned about the way I marked the exercises, it was the consensus inside the panel or even among all other teachers in our schools, we tend to give verbal comments if we found serious problem from students' answers……I myself think that I have already followed the spirit and principle of inquiry-based learning, the difference is that I also included the necessary consideration for these 3 factors.

The teacher felt that he has acted according to his beliefs in inquiry-based learning in spite of the fact that some non-inquiry elements were necessary included in his lesson.

9.2.3 Answers to the follow-up questions

The following paragraphs describe the answers of Henry to several follow-up questions prepared by the researcher.

- Key for training students' co-operation

  When the researcher asked Henry the key for training students to be co-operative and proactive in an inquiry-based lesson, the teacher gave the following answer:

  It was a process that every teacher should experience……. In 2004, when the authority launched the new PGS, all of the teachers felt uncertain and we did not know what to do. After I attended some training courses of the new curriculum, I found that the inquiry-based teaching method interesting and challenging. I tried out the methods I

learnt……. As you can imagine, at the beginning, students were too excited that you hardly moved on. However, you have to calm down the students, stop the lesson and discuss with them as a class. We have set some rules and all students know that if they behave badly at my inquiry activities, the lesson would stop and I will handle the misbehaved students one by one……

- The challenges of assessment and teaching time

  The researcher asked:

  Do you think examination limits your freedom in handling the inquiry-based curriculum?

  The teacher answered:

  Yes, it certainly did, and I think it is the biggest contradiction for this new curriculum. The government and the school administration urged us to adopt an inquiry-based approach but no one dared to assess students completely by observing their inquiry only, because parents only accept examination result. They think that examination is fair to their children…

  For the challenge of teaching time, the researcher observed that the teacher was quite rush during the lesson especially in the section of experiment and the teacher responded that:

  Teaching time is surely a problem. Within the 35 minutes or 70 minutes (double lesson), we have to handle the teaching content, the experiment and the conclusion. Within these steps, we have to take care of the classroom environment…. We cannot leave a mess to next teacher who comes into this classroom; therefore, we have to take time to clean up also.

- The problem of using IT

  The researcher wanted to clarify the arrangement for students to use IT

resources which may enhance inquiry-based learning and the teacher provided following answer:

Teachers always used computers in lesson; there is one set of computer in each classroom for teachers to use. But it is difficult to arrange for students to use computer facilities during lesson... In my experience, I have arranged for students to search the internet after lessons, may be at recess time. But the only way we can do is to encourage them to use computers at home for browsing the relevant web sites……

9.2.4 Points the teacher added

The interview was finished in a friendly atmosphere. When the researcher invited the teacher to add whatever he wanted, the teacher reminded that the success of inquiry-based learning depends on how much support we can obtain from the school and parents. To him the limitation of facilities is not the major obstacle; the real problem lies in the mindsets of parents, teachers and school administration.

9.3 Result of interviewing Fanny of school (A)

Fanny was observed teaching a lesson to a class of primary six students on the topic of "emergency services in Hong Kong". She had been identified in the initial interview as holding reservations on the basic principle of inquiry-based learning. According to the analysis of the lesson observations, she taught the lesson in a lower level of inquiry and the students were found to be less attentive to the learning content at the lesson.

9.3.1 Teacher's comment on the observation record

When the teacher read the queries in the observation record (section

8.4) she asserted that it was a normal lesson; she had finished the content she prepared to teach and the students had learnt the teaching content. After reading the observation record, the teacher showed disappointment to the preliminary comments on her lesson. She disagreed on some of the points especially the section describing her lesson as teacher dominated. She defended that after the launching of the new PGS, she has changed some practices in lessons, for example, she had prepared more activities than before and she found that it was a time consuming job to prepare the activities. On the other hand, she commented on the students' performance that they talked a lot at the PGS lessons. She thought that the students love to have group discussions because they could talk to each other and they felt that discussions were chances for them to chat. She admitted that students might not be discussing the topics the teacher assigned.

On the whole, she felt that teaching the new PGS made her tired and busy. She even explained that she was a teacher of Chinese language, so that she saw teaching PGS as something additional to her existing role at school. She showed that teaching PGS needed much more preparation work than teaching Chinese language; it was especially true when she taught the science-related content. She said that because she was educated with an arts background, every time before she taught science experiment she had to rehearse for many times and it added much burden on her.

9.3.2 The consistency between belief and action

The researcher asked:

> *As you have indicated in the initial interview that you thought inquiry-based learning might be good for students as long as teachers*

must provide ample instruction and background information and you also disagreed that 'inquiry is not about seeking the right answer'. Do you think your teaching in the observed lesson was in conformity with your beliefs?

The teacher answered:

I believe that inquiry-based learning is a new method; however, I don't agree that teacher should stand aside and allow students to acquire the knowledge by themselves… After all, they are young children. They still have to grasp concrete information and knowledge from teachers. As I have said, teaching the new PGS is difficult. I have to prepare inquiry activities but I also have to manage the teaching time because there are teaching content that I must teach…

In clarifying what she meant by "teaching content" she said:

It means the content in the textbook and the workbooks… those are the content for school internal examination.

To summarize, she insisted that she has acted according to her beliefs for what learning really means and the situation the researcher observed reflected her normal teaching practice.

9.3.3 Answers to the follow-up questions

It was a little bit surprising to the researcher that as a senior teacher, Fanny seemed to be lack of some basic classroom management techniques. Many of the students were not attentive to the lesson, they even took the chance of group discussion as a time for relaxation and free talk and the teacher seemed to have allowed them to do so. Thus the researcher started the follow-up questions by asking politely about the problem of the students' performance in the observed lesson.

- Students' problems

  The researcher brought out some situations he observed including students discussed about irrelevant things in the group discussion, teased other students who were doing the role plays and being annoyed when the teacher was lecturing. The teacher responded that:

  I also noticed that but we have to allow students to get involved in the inquiry activities therefore we cannot ask them to sit quietly like they did in other lessons…. the situation was not so bad and I think that they still learnt what they had to learn, but if you are outsider you may find they are noisy. I got the amplifier and it helped me to control them. Any way, it is the price for inquiry-based learning, isn't it?

- The challenges of assessment and teaching time

  The researcher asked:

  Frankly speaking, it gave me an impression that you cared about the model answers very much. You always reminded the students to jot down the bullet points you put on the black board. You also asked the students to refer to the content of the textbook frequently. Have I observed correctly? Does it relate to the strategies you assess the students in the PGS lessons?

  Fanny answered that:

  As I have said, no matter it is the inquiry-based curriculum or not, students have to grasped facts and knowledge in each lesson. It is important for them not only for taking examination but also for building the foundation for learning in higher level, for example if they do not have enough knowledge they will not learn well in secondary education.

  In clarifying what strategies of assessment she used, the teacher added

  The most important assessment is the examination. Although we have introduced formative assessment like the assessment of project works,

yet it only occupies a small portion of the total marks. In our school, we have allocated 10% of total marks for project works and the rest of 90% of marks are set in examinations. Therefore, you can see we have to give the students standard answers otherwise it will not be fair to test different classes in the final examination and it is also what parents accepted…

For the challenge of teaching time as disclosed in the initial interview, the teacher explained:

When we have examination we have to catch up (with the teaching schedule)…as you know, if you spend too much time in activities student may miss important time for learning the necessary knowledge which will be tested in the final examination.

- The problem of using IT

  The researcher noticed that Fanny used the electronic books to conclude her lesson. The researcher wanted to know more the experience of the teacher in using IT in the lesson. The teacher replied that she used the electronic book in every PGS lesson because she found it was very helpful in drawing the attention of the students and had they focused on the important information and content. In the question about students using IT in self-learning or inquiry activities, the teacher said:

  Students used computers to do the project works. They searched the internet and they printed out the information…I have to tell you, most of the time it was the parents who did the job of internet searching and even the typing of the report. I can tell from the report they handed in. Besides, for some students they just gave you piles of irrelevant information which they downloaded from the internet and they had never read them seriously…

Generally speaking, Fanny clearly expressed that she cared about the

examination very much, although she arranged some inquiry activities in her lesson. Furthermore, she felt that inquiry-based learning brought her extra workload and student's discipline problem is the cost of inquiry-based learning.

9.3.4 Points the teacher added

Although the researcher posted challenging questions on the performance of Fanny, the conversation was ended in a friendly atmosphere. Fanny added, she has been teaching PGS for many years but she found that the new curriculum started in 2004 has brought her much workload and she asked a question:

> *Is it necessary for teachers to prepare so many activities for inquiry-based learning?*

9.4 Result of interviewing Alex of school (B)

Alex delivered a lesson to a class of primary five students on the topic of "the story of tea". The teacher was identified in the initial interview as a supporter of inquiry-based learning. According to the lesson observation, he has demonstrated a different kind of inquiry-based lesson in which teacher-student co-operation was fluent and effective. The major focus of the follow-up interview was the design and choice of inquiry activities for the cultural topic and the building of class routine.

9.4.1 Teacher's comment on the observation record

The teacher humbly refused to accept the comment in the record that the observed lesson was a successful one. He agreed that the most difficult

part of the lesson was the topic of that lesson (section 8.5). He admitted that before the lesson he was wondering whether students would find the topic boring. It was because today's young children may not be interested in Chinese traditions and drinking Chinese tea is deemed as one of such old fashioned things. The teacher thought that it was the activity of designing advertisement that aroused students' interest in knowing more about the Chinese tea. The teacher noted that in his experience, inquiry-based activities always turn ordinary learning content into exciting one.

On the other hand, Alex appreciated his students for their proactive attitude in the lesson. He said that the students also performed very well in other PGS lessons. According to the teacher, group work was always the best strategy to involve students and provide them with opportunity to responsible for their own learning. The teacher also affirmed that sometimes it was the students' responses and reactions that encouraged the teacher to do better and to do more, especially in an inquiry-based curriculum.

9.4.2 The consistency between belief and action

Alex has shown, in the initial interview, very positive belief towards inquiry-based learning. He believed that a teacher should create an environment that would foster students' inquiry instead of transmitting knowledge to them directly. In asking the teacher to comment whether his performance in the lesson was consistent with his belief, he provided the following answer:

It depends on the topic and the content of the lesson. To me, different

types of content need different methods of inquiry. Just take the example of the lesson observed; as the theme of the lesson is about Chinese culture, it is arguable that which kind of activity could help culture inquiry.

He further articulated that:

Reading of prepared information could also be described as useful activity for inquiry especially for the historical and culture issue although some people may think that it is traditional method…It may not be some sorts of experiment; it may not be building hypothesis; it may not be testing anything. However, it is the inquiry of the whole picture of the issue. Therefore, it is the effectiveness and direction of the whole lesson that are important but not the differentiation of which activity is inquiry and which is not.

The teacher insisted that what he did in the observed lesson and other lessons were consistent with his belief in inquiry-based learning despite that he has to adjust the methods and activities for inquiry of different nature of knowledge.

9.4.3 Answers to the follow-up questions

The most impressive aspects of the lesson observed were the creativity of the teacher in designing inquiry activity and the well trained class routine of the students. The teacher shared following views in these areas.

- <u>The design of inquiry activity</u>

  Alex said:

  As I told you the topic about Chinese tea was boring to students so I have to think of something that would motivate them especially they had to read some boring information about Chinese tea…Well! I prepared the lesson for three day; the idea of designing advertisement came to my mind when I thought about the activity I should use in helping students

to find interest in this topic.

- The building of class routine

  The teacher said:

  My students have been trained for two years. In the beginning my students were very passive and I have to handle all the things in the lesson. About two years ago I started to invite several students to help me. In my experience students were willing to help but you have to appreciate them in return and you also have to let different students to help you.…In lessons of inquiry nature, students' participation is very important once they feel that it is their lessons they will focus much more.

- The problem of assessment and teaching time

  The researcher asked the teacher that:

  When I observed your lesson, I found that you were also observing your students during the group discussion section. Did you assess them for their performance in group works or in the process of the inquiry?

  The teacher answered that:

  Yes, I did, I assess them for their contribution and participation in the group and I tried to provide instant responses to their discussions. However, as you saw, I could only handle two or three groups of students within that 10 to 20 minutes time. Therefore, when I said that assessment and teaching time were both major challenges to me in the new PGS, I meant these two factors affect each other…

  The researcher thus asked follow-up questions about the effects of examination on the teacher's teaching. The teacher responded:

  Yes, examination is still the major assessment tool in our school but for the PGS we have some progress in this aspect. We have to take into consideration the performance in class, project works as formative

assessment. They occupy 30% of the total marks. It is the consensus of our panel members…

- The problem of using IT.

  The researcher noticed that the teacher used the power point presentation for stimulating students and providing some background introduction to the topic of the lesson. The teacher disclosed that IT did help him in presenting the images and information that could stimulate students' interest. He said that teachers and students used IT presentation frequently at different lessons. It was not only the teacher who would use the computer and the projector; he would also allow students to use the facilities to present their findings from the project works.

The teacher clarified how he trained up the students in participating in the inquiry-based lessons and he shared his experience in preparing creative activities for students' inquiry. On the whole, the interview revealed that the teacher has put forth much effort and time in preparing his lessons and training up his students for the regular practice at lessons.

9.4.4 Points the teacher added

The interview was an enjoyable experience. The researcher saw a young teacher with great enthusiasm; Alex. At the end of the interview the interviewee was invited to make any comment and he added that he has seen the success of the inquiry-based learning in his school. He said:

As the advance of the IT and most of the teachers can spare more time

for inquiry activities and it is the right time to promote inquiry-based learning to other subjects.

9.5 Result of interviewing Peter of school (B)

Peter was observed in a lesson teaching a class of primary two students on the topic of "making friends". It has been found in the observation that the teacher has tried his best to maintain an inquiry-based lesson and yet the effect of the lesson was not satisfactory. Students' misbehaviour always interrupted the progress of the lesson. The major areas to be discussed with the teacher are:

1. The background and history of the class of students being observed at lesson.
2. The problem of implementation of the inquiry-based lesson on junior level students especially the disciplinary problem thus created.

9.5.1 Teacher's comment on the observation record

After reading the record (section 8.6), Peter showed a helpless face to the researcher. He told the researcher that the students always behave like that. Once the teacher allowed them to have group works they created noise and moved around. The teacher had to discipline them. Speaking of the comments on his performance; the teacher defended that he has followed the principles of inquiry-based learning and he found that it was very difficult to do so on junior level students. Yet, he added that it might be due to his own problem, he thought that he was not good at teaching students in such method.

For the record about students' performance, the teacher added that they

were very naughty and they did not pay attention to teacher's instruction. The teacher had to stop the lesson many times to handle the troubles they created. The teacher said that he was still trying different methods to manage that class of students. Overall, the teacher thought the observed lesson was not a good example for inquiry-based lesson and he felt a bit guilty for it.

9.5.2 The consistency between belief and action

Peter was identified as holding reservation in applying inquiry method to young children. He had declared in the initial interview that his own experience told him that inquiry-based learning did not work in junior level. The researcher asked the teacher to comment whether his own action in the observed lesson reflected his beliefs in inquiry-based lesson. The teacher answered:

> *Frankly speaking, I don't actually believe that inquiry-based learning is an effective approach…further; I discovered that sometimes it is difficult to apply just one single teaching method to different students. What I did in the lesson simply proved that applying inquiry-based learning on students without self-management could create problems in classroom.*

Nevertheless, Peter admitted that he would follow any decision made in the panel meeting because he believed that teachers in a subject should act as a team and the instruction of the new PGS Guide should be observed by all PGS teachers in Hong Kong.

9.5.3 Answers to the follow-up questions

The researcher was curious about the background of the observed students because it seemed abnormal for a class of primary two students to perform so negatively in the lesson. They should have learnt the classroom rules and have been trained to work with the teacher. Therefore the first follow-up question was about the background and history of the observed students.

- The background of the observed students

  In answering the question about the students' background, the teacher disclosed that:

  Basically, this is a normal class without any special background. Nevertheless, by coincidence, there were more active students in this class. The 6 or 7 vigorous students always influence others' emotion and entail reaction in the lesson. In the group work section, they will easily lead other students to funny tricks instead of discussing the tasks assigned by me……..As you can see I was tied up by the problems they created!

- Did inquiry-based learning cause the problem?

  When discussing the relationship between inquiry-based learning and the discipline problem of the students, the teacher explained that:

  [4]*I think the discipline problem you observed, came from two sources. First, these students were excited in PGS lessons. As I noticed, they behaved properly in lessons of mathematics or Chinese language, these*

[4] In Hong Kong primary schools, within the same class of students, different subjects are taught by different teachers, therefore, the teacher mentioned the difficulty for him to lead an inquiry-based lesson while other teachers of other subjects are still teaching in traditional way.

subjects are taught in a traditional way that means teachers talk and students listen… I think they were so excited because PGS is the only subject allowed them to have so many group works and independent works. Second, truly speaking, I myself have become another source for their excitement. I have been struggling between class management and open atmosphere in the class. Until recent months, I found that it has been getting out of control…. I have to handle the misbehaviour of these young children all the time instead of helping them doing any meaningful inquiry.

- The challenges of assessment and teaching time

  For the question of assessing students the researcher noticed that the teacher seemed to have no time to assess the students during the lesson. The teacher defended that

  Yes, you may say that I didn't have time to assess them at lesson. As you know, I had to make sure the students were doing the assigned tasks instead of anything else and it took most of my time…, I assess the students in their home works and in the beginning of next lesson. I will ask them the content I have taught in this lesson…

  In answering the question about teaching schedule and teaching time the teacher said:

  It is tight and (the lesson) has to be caught up. In our school we have only 4 PGS lessons and we have to finish the content assigned in the PGS curriculum. We have to finish the content no matter whether you use traditional approach or inquiry-based approach.

- The problem of using IT

  The teacher did not use any IT facilities in the lesson except he has prepared the pieces of notes for discussion for each group. The teacher commented the assistance of IT that:

I will use the projector to present the power point but not in the lesson you observed. However, IT is not so useful for young children; they have not learnt to search the internet although some students may have learnt it at home.

After all, the teacher showed that he needed assistance and backup and it seemed that he has not got some. Although he kept on trying the inquiry-based methods, he already concluded in his heart that it has never succeeded.

9.5.4 Points the teacher added

Throughout the follow-up interview, Peter showed attitude of helplessness and regret. It can be told from his face that as an experienced teacher he was facing a critical moment in his career. In the end of the interview the teacher added:

The government does not need to launch a single approach to all schools. May be the teachers and the schools understand what kind of teaching method best suit their students…

9.6 Summary of the data checking and the follow-up interview

As a follow-up action for the previous data collecting procedures, the data checking and the follow-up interviews have clarified following areas:

1. All the interviewed teachers commented that both teachers and students have performed normally in the observed lessons in spite of the fact that some lessons were more successful than others. Hence, the situation being observed should reflect the normal situation happening in every day. Besides, all the interviewed teachers deemed that their

performances in the observed lessons were consistent with their beliefs in inquiry-based learning. However, it did not exclude the possibility that some teachers might have behaved according to some outside pressure, rather than followed their own beliefs; Peter was an example. Peter was putting effort in implementing inquiry-based approach but it was not because he believed in such approach, but rather he is an obedient teacher who would follow any decision of the subject panel and the instruction in official guideline. It reflects a sort of alternation of behaviour of individual teacher when implementing the new curriculum.

2. It has been raised in the section of lesson observation that Henry and Alex seemed to have divergence between their claimed belief and their actions at the observed lessons. The teachers explained the situation. Their justifications included that some teacher-centered methods may be added to an inquiry-based lessons (as in the case of Alex) according to the nature of the inquiry; in authentic situation teachers have to take into account other considerations other than one's own beliefs (as mentioned by Henry).
3. The co-operation of students has to be earned through sincere dialogue between teacher and students, careful design of inquiry activity, setting class rules and building of class norm. It is true in cases of Henry and Alex. Once the students found the lesson meaningful and interesting they get involved.
4. However, unlike Henry and Alex, Fanny of school (A) faced the same challenge but showed different responses. When Fanny faced the problem in keeping student discipline and co-operation, she saw the

problem as the "*price of the inquiry-based learning*".

5. The situation of assessing students was different in the two target schools. In school (A), the pressure of examination was higher and thus its effect on the implementation of inquiry-based learning was also greater. In school (B), the school allowed teachers to allocate 30% of marks for formative assessment; teachers of school (B) had higher degree of autonomy in adopting assessment strategies, which could benefit inquiry-based learning. For example, the observation of students' performance at lesson, the result of group projects and etc. Nevertheless, only Henry and Alex felt that the reliance on examination is contradicted to the spirit of the inquiry-based learning.
6. For another challenge mentioned earlier, the time factor, the follow-up interviews proved the observed situation that all teachers were constrained by the tight teaching schedule. The time factor even imposed great pressure on some of the teachers who tried to include more inquiry activities in their lessons (for example, Henry and Alex).
7. On the other hand, it has been discovered that the challenge of assessing students and teaching time was interrelated in two aspects. Firstly, teachers who had managed the lesson better, invited the co-operation from students and had designed effective inquiry-based activities, found more time to carry out assessment that could enhance inquiry-based learning (i.e. formative assessment). Second, teachers who cared for the examination more, found the teaching schedule tighter, because they had to catch up with the teaching content that will be tested in the final examination. In fact, the "catch-up-examination" thought seemed to have affected Fanny seriously.

8. For the investigation of using IT to enhance inquiry-based learning, the follow-up interview revealed that most of the time it was the teachers who used IT at lesson. Students seldom had the opportunity to use the IT resources mentioned in the school documents. At this moment, the biggest progress was assigning students to search the internet at home and used their computers to make the project report, except Alex who has arranged students to use the computer in the classroom to present their reports.

9.7 Implication to the theoretical framework

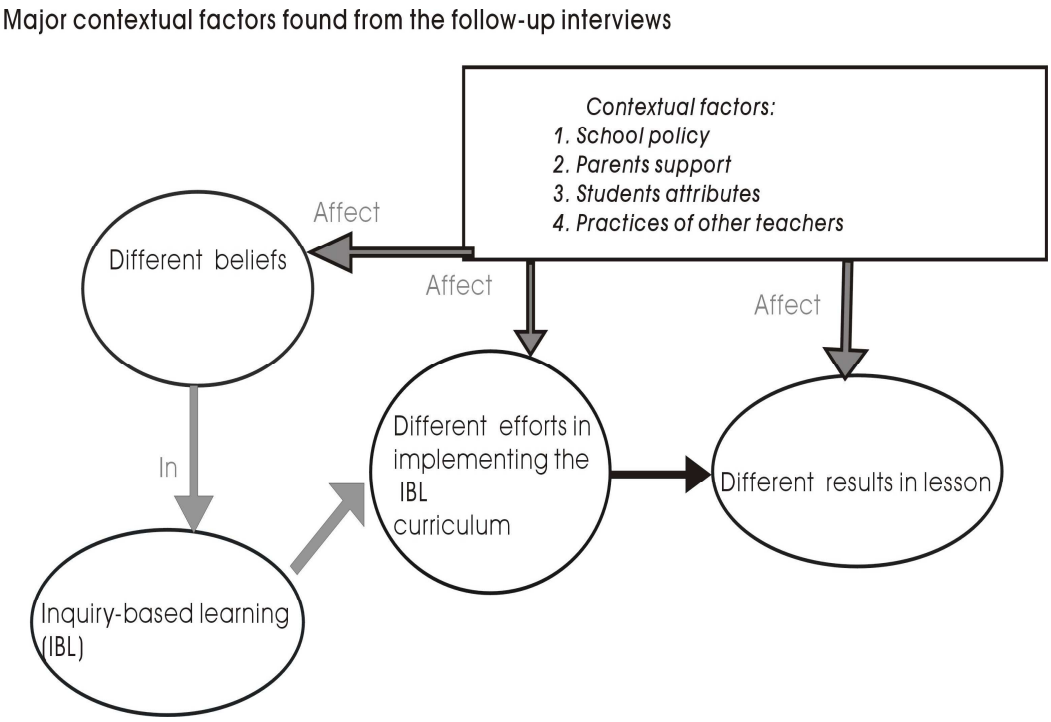
Besides clarifying the unclear areas, the data checking and the follow-up interviews also brought new insights about teachers' beliefs and inquiry-based learning.

1. The interviews answered the question emerged from the observation that those teachers showed more positive beliefs towards inquiry-based learning did put forth more effort and time in preparing the inquiry-based strategies in lessons and they also obtained more positive results. Therefore, it was not only the adoption of the inquiry-based strategies that made the lesson success, but also the effort in preparing those learning activities and training up the students' practices in lessons (figure 9.1).
2. The follow-up interview provided valuable information on the contextual influences on teachers' belief formation and the implicit belief in practice (theory-in-action of Sigel, 1985) of the teachers involved .Three major contextual factors have been identified to have impact on teachers' actions. First, parental support and pressure are crucial. Such reminder

was mentioned by Fanny, Alex and Peter. For example, according to the teachers, for those parents who had bought computer facilities and had ordered newspaper at home, their students performed better in their home-based inquiry assignments. Second, Alex affirmed that sometimes it was the student's responses and reactions that encouraged the teacher to do better and to do more, especially in an inquiry-based curriculum. Hence the better preparation for the inquiry-based lesson entail better reaction from students and it encourage the teacher to do even better in return. Third, Peter raised one interesting point when answering the follow-up questions. He pointed out that since other subjects in his school were taught in teacher-centered approach, the PGS lessons became victims. Students took the inquiry-based activities as a time for relaxation and liberation. In fact, such situation also occurred at the observed lesson of Fanny. In the aspect of theory-in-action, Henry mentioned his implicit concern about the three major factors *"parents' expectation, school's administration and practices of other colleagues"*. Such consideration is also the evidence of the contextual influence on Henry's belief formation. As O'Loughlin (1986) mentions, the observation of other colleagues' practices contribute to the formation of a teachers' belief formation, especially about the theory-in-action, that is the way a teacher do something because of some consideration behind. Similar contextual influence can also be found when Fanny defended her perceived role as a language teacher, rather than a PGS teacher. Alex believes that different areas of knowledge need different modes of inquiry. Peter also holds an implicit theory that there is no one approach can help all students.

The data checking procedure and the follow-up interviews also supplied rich details for analysing the authentic situation of how teachers' beliefs affect the implementation of inquiry-based learning. In following chapters, the researcher will discuss the relationship and meaning generated from various data collected. The sub questions of the research question will act as the framework of such discussion.

Figure (9.1) Major contextual factors found from the follow-up interviews



Chapter 10

Discussion

10.1 Introduction

The following paragraphs discuss the findings obtained from the study and it analyzes the interrelationship between teachers' beliefs and the implementation of inquiry-based learning in the PGS curriculum. It also compares the situations observed from the two target schools. The discussion is organized according to the sub questions of the research question and the theoretical framework.

10.2 What are the teachers' beliefs in inquiry-based learning? (Sub question 1)

As the first sub question in this research, it was designed to obtain information for the major component of this study: teachers' beliefs in inquiry-based learning. During the study, there were several sources for investigating such beliefs. First, the direct sources included the opinion given by target teachers at the initial interviews and the follow-up interviews and the behaviour of teachers in the observed lessons. Second, the indirect sources included the information found from the school documents and the students' works.

10.2.1 Different beliefs towards inquiry-based learning

After analyzing the data obtained from the direct and indirect sources, it leads to following conclusions.

The PGS teachers of the target schools were holding different core

beliefs and beliefs about praxis (Sigel, 1985) towards the basic principles of inquiry-based learning. As shown in the initial interview, different teachers from the two target schools hold different core beliefs about teacher's role and student's learning. Some believe that teachers should be facilitators in students' learning; some believe teachers should be knowledge transmitters. Similarly some teachers believe that even in inquiry-based learning, learning should be about seeking the ultimate right answers while some other teachers believe that seeking the right answer is not the principle of inquiry-based learning (as showed in figure 5.1). Such variation of core belief matches the findings in the literature review that different people carrying different beliefs towards inquiry-based learning and the roles of teachers (e.g. Brandes & Ginnis, 1986; Entwistle,1970; Saylor and Alexander,1974; Lewy, 1991; Gerstenmaier & Mandl, 1994).

The variation in teachers' beliefs about praxis towards how inquiry-based learning should be led, also manifested in the follow-up interviews when some teachers explained that including some non-inquiry teaching strategies was also a kind of inquiry (e.g. Alex of school B), teachers should provided ample instruction and information before asking students to inquire (e.g. Fanny of school A). It echoes the findings in literature review that different people interpret inquiry-based learning in different ways (e.g. Brandes & Ginnis, 1986; Lewy, 1991; Gerstenmaier & Mandl. 1994).

In addition, the study also discloses that the beliefs about inquiry-based learning as carrying by some teachers have not developed into their "theory-in-action" (Sigel 1985); hence, there are different judgments by teachers that inquiry-based learning has its "value in theory" but not the "value in practice". Such difference was shown by the fact that even though

some teachers understood the advantages of inquiry-based learning they seldom used it in their classrooms. It helps to explain the findings in the literature review that teachers still showed hesitation in actually adopting inquiry approach in their lessons (e.g. Anderson, 1998; Young, 1991). Such a phenomenon also manifested in the fact that some PGS teachers (Henry and Alex) gave different responds over different situations. It may be because in the initial interview, the researcher only asked the teachers to comment on the principles of inquiry-based learning by judging the written statements of the PGS Guide. However, in the follow-up interviews, teachers had to defend what they did in the observed lessons and they had to consider authentic factors beyond the ideal theoretical situation. In other words, we may as well say that their beliefs were mediated over different situations. In this study, the mediation is shown by two levels of belief; the first level is the verbal level another one is the action level. Such a conclusion fits with the importance of contextual influence in belief formation and practice as suggested by Sigel (1985) and the findings that teachers' action is inevitably mediated by numerous contextual variables (e.g. Bennis, Bene & Chin, 1985; Clark & Peterson, 1986; Cheung &Wong, 2002).

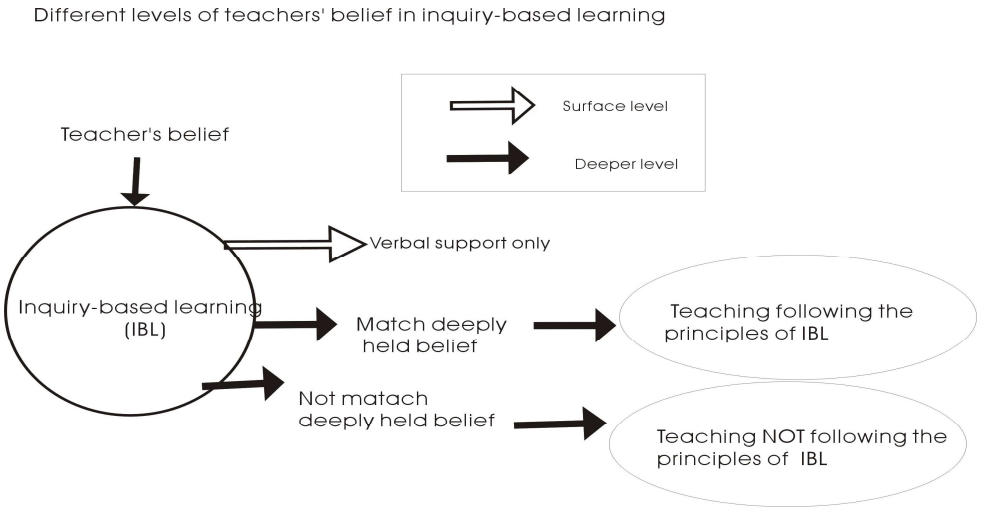
Such a difference in teachers' belief levels may supplement the theory of Sigel (1985) that, it is not only the interaction of different components of belief that generate the final action of a teacher, it may be necessary to assess the intensity and level of different belief components that have affected a teacher. For example, when the core belief of a teacher about the teacher's role as a knowledge transmitter is so strong and well developed that the training for inquiry-based teaching method (the agent inducing the change in belief) may only change the teacher's belief in a superficial level (e.g. the

verbal level) but never change the teacher's action in lesson, or in other words, it is difficult for the teacher to internalize such training into his theory-in-action.

10.2.2 A conclusion of the sub question (1)

As discussed in the literature review (e.g. Olson, 1981; Archer, 2000) teachers' decisions are based on deeply held beliefs about teaching. Therefore, until verbal support has become teachers' deeply held belief, teachers may not actually put inquiry-based learning into action. The explanation of the different levels of beliefs supplemented evidence cited in the literature review and the theoretical framework and it is illustrated in figure (10.1). As discussed in the literature review, different core beliefs about learning and teachers' roles lead to the choice of different types of teaching method and classroom activity (e.g. Fernstermacher and Soltis, 1986; Calderhead, 1996). This research concludes that it is not only the variation in core belief content but more important it is the difference in levels of core belief that affect teachers' actions. It supplements the perspective of Sigel's belief-action relationship. Therefore even the teachers accept the pedagogy of inquiry-based leaning in a verbal level or theoretical level, such acceptance may not infringe teachers' deeper core beliefs, since the core belief is well developed at a deeper layer and become implicit theory-in-action for all kinds of behaviour of the teachers.

Figure (10.1) Different levels of beliefs in inquiry-based learning



10.3 What are the impacts of teachers' beliefs on the implementation of inquiry-based learning in the PGS curriculum? (Sub question 2)

Morris (1998) reminded us that a new curriculum is only successful if it is implemented. He also pointed out that there is a distinction between adoption and implementation. There is handful of examples in Hong Kong showing that adoption of a new curriculum did not mean an actual implementation of the new curriculum (e.g. Visiting Panel, 1982; Morris, 1984; Opper, 1992). The results of this study also show that in some teachers' lessons, the inquiry-based method was adopted but not implemented. The following paragraphs answer the second sub question of this research and discuss the details of how teachers' beliefs affected the implementation of inquiry-based learning in the target schools.

10.3.1 The impact on teachers' preparation works

The lesson observations reflect that some teachers prepared the PGS lessons better than others did. Henry of school (A), who was carrying

positive beliefs in inquiry-based learning, had spent more effort in preparing the lesson than another observed teacher in the same school. He taught the topic of "*what kind of objects will float in the water?*" and "*what kind of shapes help object float in the water?*" He arranged sets of tools and materials for the experiments. He also designed a power point presentation for reminding students' experience on observing objects that float in water. Other than these physical facilities and tangible teaching aids, Henry also devoted his time in thinking about the flow of the inquiry. As the lesson observation revealed, the delivery of the inquiry questions, the administration of the group discussions and experiments and even the cleaning job after the activities were all smooth and efficient. The important point is that the teacher confirmed in the follow-up interview, he has been doing the same things in all PGS lessons. The observed lesson was not an exhibition. In addition to that, it was also disclosed at the follow-up interview, the teacher believed that he should prepare a rich environment that would foster students' inquiry in the lessons.

Similarly, another teacher with positive belief in inquiry-based learning, Alex of school (B), also put more effort in preparing the lesson as comparing to the other observed teacher in the same school. As indicated in the follow-up interview, the teacher spent three days for designing the activities that would arouse students' interest in investigating the characteristics of Chinese tea and he also prepared the printed information about different species of Chinese tea. He believed that teacher should try his best to arouse the interest of students in the inquiry. He adopted some traditional methods in the lesson (e.g. reading of prepared materials and listening to the legend told by the teacher) and such action was once

challenged by the researcher as violating his beliefs as expressed in the initial interviews. Nevertheless, such action was also affected by his belief that *"different kinds of knowledge need different types of inquiry"*.

In contrast to the stories of the above teachers, Fanny of school (A) was carrying relative negative belief towards inquiry-based learning, prepared her lesson in a different manner. As she disclosed in the follow-up interview, she mainly saw herself as a teacher of language subject and teaching PGS was an additional job to her main role (see section 9.3.1). She complained at the follow-up interview that teaching PGS added her workload and made her tired as she had to prepare more activities than before and she found that it was a time consuming job to prepare the activities. Under such belief, she managed to add some activities that were recommended in the PGS Guide (e.g. group discussion and role play). Yet, such activities were not planned carefully. For example, the teacher allowed students to discuss one simple case for 15 minutes. The discussion was not challenging and most of the groups finished the discussion within 5 minutes. Hence, her students started to discuss their own topics. Besides, the teacher also believed that teachers should provide ample instruction before asking students to do any inquiry (see section 9.3.2) and, as observed at her lesson, such a belief had directly affected the planning of her lesson as she planned a 20 minutes lecture at the beginning of the lesson. Such lecturing made students boring and took away their motivation to learn proactively in the lesson.

In the case of Peter of school (B), another teacher carrying reservation towards inquiry-based learning, he expressed the same belief and opinion that inquiry-based learning does not work in young children. No matter such

belief is sustained or not, Peter prepared his lesson under such rationale. He only allowed his students to have limited time for inquiry-based activity at the lesson and the teacher dominated the rest of the time. It may reflect that the teacher worried that too many inquiry-based activities create chaos.

Therefore, different core beliefs in the roles of teacher and belief about praxis for implementing inquiry-based learning led to various degrees of involvement and different decisions of PGS teachers in preparing the lessons.

10.3.2 The impact on management of the PGS lessons

When Henry of school (A) holds the core belief that as a teacher he should provide a rich environment for students to inquire, he did arrange such environment by putting effort in preparing physical facilities and materials. Similarly, when he holds the belief that teacher should only act as a facilitator of learning he organised the lesson with mainly challenging questions and opportunities for students' inquiries. As shown in the lesson observation, most of the time the teacher was asking questions instead of giving answers. He also allowed students to ask questions. The observation also disclosed that even when his students encountered difficulties and asked him questions, he did not comment the difficulties directly; rather, he challenged students' hypotheses and encouraged the students to rethink the whole process of inquiry (see section 9.3). Although it has been discussed, Henry's belief in inquiry-based learning has been changing slightly over different stages of the study and he had included some traditional methods in his lesson. His beliefs that "*teacher as facilitator*" had been demonstrated

in the management of his lesson, especially in following the principles of inquiry-based learning.

Comparably speaking, Alex of school (B) also managed his lesson according to his core beliefs and belief about praxis. He expressed in the initial interview that he believed in the basic principles suggested by the PGS Guide about inquiry-based learning (teacher is the facilitator of learning and inquiry is not much the seeking of right answer). He demonstrated in the observed lesson that his major objective was to arouse students' interest to inquire into the characteristics and features of Chinese tea. He guided students to digest relevant information and discuss among themselves the selling points of different species of Chinese tea. In addition, Alex also expressed in the follow-up interview that he believed in using different types of inquiry to inquire into different nature of knowledge. As a result, he chose to tell stories of traditional legends about Chinese tea (with the assistance of a power point presentation), he delivered information on different varieties of Chinese tea and asked students to work in groups to design advertisements to sell the type of tea they were studying. Such a choice of teaching strategies was built on his belief about praxis that reading relevant information and listening to historical legends were effective strategies for helping students to inquire the knowledge with cultural and historical nature.

The lessons of Fanny of school (A) and Peter of school (B) also reflected the effects of their core beliefs and belief about praxis on their teaching behaviour and class management. When Fanny believed that teachers should provide enough instruction and students should acquire enough knowledge from the lesson (her belief about praxis), she used about

one quarter of teaching time to lecture and explain the content in the textbook. Although she still included some inquiry-based activities, her attention was on the conclusions prepared by her, instead of those inquired by students (see section 8.4).

In the lesson of Peter, the researcher found that the teacher was putting greatest effort in maintaining discipline, although he also tried his best to make the lesson looked inquiry-based. Actually, the teacher confessed that in the past, he tried to allow more freedom for the children so as to encourage them to engage in inquiry-based activities but he found that he was loosing control of the lesson (see section 9.5.2), hence he holds the core belief that he must put discipline before everything. As a result, he interrupted the lesson so frequently that students lost the interest in learning. The teacher disciplined the class at the cost of students' motivation to inquire. Besides, the teacher also holds the belief about praxis that he should provide suitable instruction and guidance for students before asking students to engage in any inquiry and he had reservation in accepting the principle *"inquiry is not about seeking the right answer"* as applied to junior level students. Consequently, he prepared model answers for his inquiry-based activity, the group discussion on "*how to become a good friend of others?*" That in turn affected students' motivation to share their conclusions because they knew that the teacher would not accept other answers.

10.3.3 The impact on assessing students

Assessment is the crucial part of the inquiry-based learning (Alberta Learning, 2003). Besides, the interviewed teachers have mentioned that

assessment was one of the major challenges to them in implementing inquiry-based learning. Therefore, it is essential to look at the effect of teachers' beliefs on the assessment of students' learning in the target schools.

First, the documents of the target schools shows that formative assessment is encouraged (to the schools, the definitions of formative assessment is simply the coursework for grading), yet standardized examination still played a crucial role. Besides, It was also reflected in the meeting minutes of school (B) that teachers faced difficulties in assessing the inquiry process, the generic skill and the attitude in inquiry (see section 6.3).

In the analysis of students' works, the researcher also found that in school (A), no matter, what beliefs the teachers carrying, the assignments were focused on knowledge rather than process, skill and ability. It has been concluded in the analysis of the students' works that even Henry of school (A) who was carrying positive beliefs towards inquiry-based learning, use the same method and criteria to grade the assignments as other teachers who held negative belief in inquiry-based learning. On the contrary, in school (B) even though Peter held reservation towards inquiry-based learning, his marking of assignments still exhibit the encouragement to students' inquiry, just like other teachers in school (B) did. That means the impact of teacher' belief on the designing and grading of students' assignments is not obvious. In fact, it has been discussed in the section about students' works that, the design of assessment as in the form of written assignment, test and examination, and the way teachers mark the assignments are the decision of the school administration (as in school A) or the common decision of the members in the subject panel (as in school B), instead of the choice of individual teacher.

Nevertheless, it has been found in the observations that Henry of school (A) and Alex of school (B) tended to pay more attention to the process of students' inquiry (at least during the informal assessment). They gave feedback and asked follow-up questions when students were discussing and doing experiment. Such a tendency may be affected by the core beliefs of those teachers that it is the process that matters but not the results of inquiry. In fact, it is another side of the same picture; *"inquiry is not much the seeking of a right answer"*.

On the other hand, Fanny of school (A) always prompted to provide model answers to students without commenting on the answers supplied by students. Even during the group discussion section, she showed not much interest in students' discussion and she rarely gave feedback to her students. It implied that Fanny cared about the final answers or the pre-selected knowledge of the lesson. Her decision to adopt such a strategy in assessing students may be, to a certain extent, related to her core beliefs and belief about praxis that teachers should provide ample knowledge to students and there should be a right answer for each question even in inquiry approach.

In the case of Peter of school (B), he paid very little attention to the inquiry process. He even told the students only to discuss verbally. He did not ask students to record anything. As mentioned, he was busy in handling discipline problem and solving troubles during group discussion. Even during the section of reporting of discussions, he was busy in maintaining the discipline of the audience and hence gave very little feedback to the reported content of the students. Such a phenomenon may also be explained by the contextual influence in the teacher's belief, especially when he believed that discipline came first after he encountered discipline problems in lessons. As

expressed in the initial interview, Peter supported the spirit of inquiry-based learning. Yet, he persisted with a core belief that such approach does not work with young children. Consequently, such a core belief may have led to an attitude that neglected the real assessment of the inquiries of students.

As mentioned earlier, the assessment strategies of the target school were not only affected by teachers' beliefs but also many other contextual factors. The examination, the control imposed by the school administration and the pressure from parents were the major reasons for the compromise in adopting a new teaching approach with old assessing strategies. Yet, detecting from the informal assessment at lessons, the researcher saw that positive beliefs in inquiry-based learning led to putting more attention on the assessment of the inquiry process while less supportive beliefs in inquiry-based learning led to concentration of teachers' attention on final results of the lessons.

10.3.4 The impact on teachers' reactions to challenges

As it has been analyzed in the literature review that, inquiry-based learning entail special pedagogical requirements for teachers. Some precedents have demonstrated that adopting inquiry-abased learning creates many challenges for teachers (e.g. Olson, 1981, Keys &Kennedy, 1999, Kirscher et al, 2006). In this study the researcher found that teacher's belief also affect teacher's reactions to such challenges. It has been discussed that Henry of school (A) and Alex of school (B) devoted more time and effort to prepare their lessons. Other than that, they also have one common feature. They have put forth effort in solving difficulties and improving the inquiry process. In the case of Henry he said that he has trained his students for

years in taking up their duties and co-operating with the teacher in the PGS lessons. He admitted, three years ago, when he first tried out the inquiry-based approach, the situation was unsatisfactory. He had to calm down the students and stop the lesson and then he discussed with the class. Then they set class rules and after that the situation began to improve (see section 9.2.2). The result was impressive as described in the chapter of lesson observation (see section 8.3).

A similar situation also happened in school (B). Alex had not been blessed with co-operation from his students. As shown in his school document (i.e. the meeting minutes), PGS teachers in school (B) have been discussing ways to overcome difficulties in implementation of the inquiry-based curriculum from September 2006 till June 2007 (also see section 6.3). Alex disclosed in the follow-up interview that he started to invite students to act as helpers and build up class routine for two years. Before that, students were passive and showing no responses to the inquiry-based activities. During the lesson observation, his students performed very well in helping the activities run smoothly (see section 9.4.3).

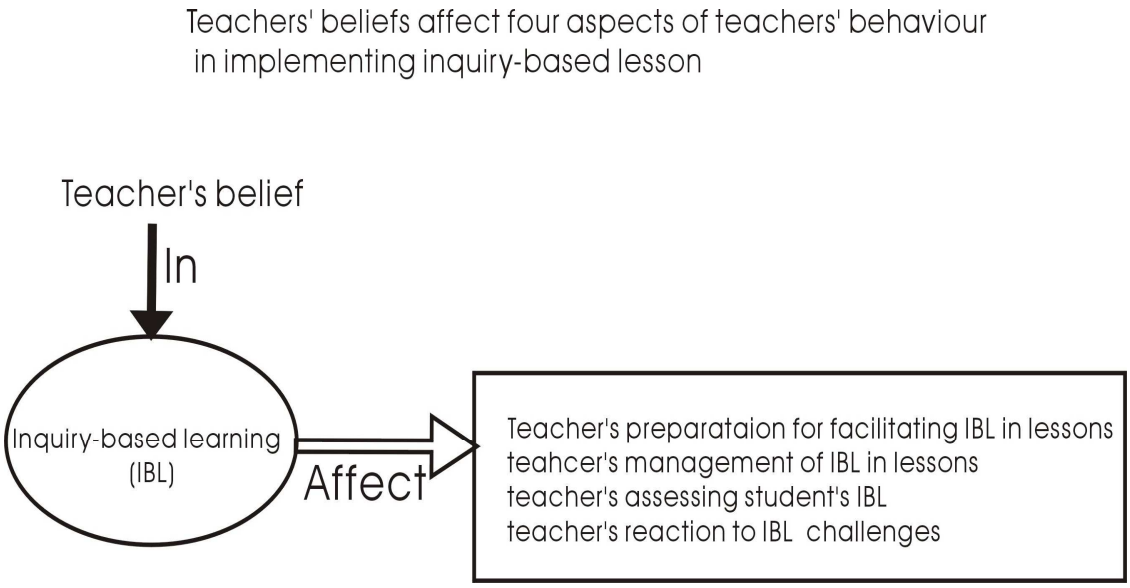
In these cases, the core beliefs that students are the owners of the learning and teachers only act as facilitators, deeply affected the ways teachers reacted to the challenges and problems. On the contrary, teachers who bore the core belief that they were the masters of the classes and they owned the lessons probably found a dead end in solving the problems emerging from introducing this new teaching approach. In the case of Fanny of school (A), when she noticed the problems of students' discipline, she only blamed the decision of adopting the new approach. There was no

evidence that she had tried to tackle the problem. Such a reaction may be affected by her core belief that students learn better in a teacher-centered environment and teacher should dominate the lesson even in an inquiry-based curriculum, therefore, the situation went out of control and she thought that it was the price for adopting the inquiry approach (see section 9.3.1). Certainly, her implicit core belief that, she was a language teacher and teaching PGS was something extra for her, has also led to a negative reaction, when she faced difficulties during her trying out of inquiry approach.

Such an analysis may also explain the situation of Peter of school (B). When he bears the core belief that inquiry-based learning is not suitable for young children, he turned to other directions for solutions to tackle the problems happened in his PGS lessons. He asserted that students must be disciplined first. Hence, when he saw his students' problems, he did not consider methods to improve the lesson, rather, he turned to measures of stronger teachers' intervention and control.

These stories imply that when teachers face difficulties, their core beliefs may govern their responses and reactions. Such findings echo the result of the literature review that "beliefs" are dispositions to action and major determinants of behaviour (Brown and Cooney, 1982). Certainly, various reactions towards difficulties are the critical factors determining the success or failure of a lesson.

Figure (10.2) Teachers' beliefs affect four aspects of teachers' behaviour



10.3.5 A conclusion of the sub question (2)

The second sub question of the research question was designed to examine the impact of teachers' beliefs on different aspects of implementation of inquiry-based learning in the PGS lessons. Although it has been discussed in the literature review that different teachers' beliefs affect the implementation of the inquiry-based learning, (e.g. Olson, 1981; Schmidt & Kennedy, 1990; Tompson, 1992; Roehrig &Kruse, 2005), above finding provide more specific content of such effects. When teachers' core beliefs are in tune with the basic principles of inquiry-based learning, they would plan and manage the lessons according to the principles of inquiry-based learning. Further they would also figure out solutions for tackling the challenges and difficulties arose from the adoption of inquiry-based learning in lessons. On the contrary, if teachers' core beliefs do not in tune with the inquiry theory, the teacher may would not spent so much effort in planning and managing

the lessons according to the inquiry approach. When those teachers face difficulties during implementing of inquiry-based learning, they may jump to the conclusion that inquiry-based learning does not work and hence they may turn to other strategies for evading the challenges. However, in the aspect of assessment of student's learning, the impact's of teacher's personal belief is not so obvious in formal assessment as it is in the informal assessment during the lesson time.

10.4 What are the contextual factors affecting the implementation of inquiry-based learning in the PGS curriculum? (Sub question 3)

After the articulation of the impacts of teachers' beliefs on various aspects in implementing inquiry-based learning, one may easily jump to the conclusion that teacher's belief is the major determinant of the existing situation of the implementation of inquiry-based learning in the cases studied. However, as discovered in literature review, teachers are constrained and influenced by many different factors other than their beliefs. The following paragraphs discuss such factors as disclosed from this study.

10.4.1 Factors affecting teachers' beliefs

There were surely many factors affecting teachers' implementation of inquiry-based learning. Some of the factors directly affected the formation of teachers' beliefs as Sigel (1985) suggested, while others were exerting their influence as constraints and limitations when teachers made decisions during the implementation (see figure 10.2). The following factors might have affected teachers' beliefs directly.

1. Background of teachers

As indicated in the analysis of initial interview, teachers' bibliographical factors may have contributed to the sources of beliefs (Sigel 1985) of teachers. It has been found that, those educated with science discipline seems to be easier to accept the inquiry approach in the PGS. Henry and Alex are typical examples. However, other than the educational background and teacher's working duties held (i.e. the panel chairpersons of the PGS), the influence of bibliographical factors is not obvious in this study.

2. <u>The teacher-centered practice</u>

One of the major reasons for some teachers to resist the principle of *"teacher as facilitator of learning"* and *"inquiry is not much seeking the right answer"* may lies in the conventional practice of the schools. As discussed in the literature review, teachers tend to reproduce traditional authoritarian and didactic patterns of instruction in schools (O'Loughlin, 1989). In addition, local teachers tend to adopt a traditional teacher-centered approach in teaching (So & colleagues, 2005). Some teachers may worry that once teachers have to stand aside and allow students to take the ownership of their learning, the traditional pattern of teacher dominating the lessons may disappear. It may create discipline problems and the class may be out of control. In fact, it has been showed in the lesson observations that those who tended to resist such principles did encounter the difficulties they worried about. After all, as indicated in the literature review, role confusion of teachers (e.g. Soltis, 1986; Nespor, 1987; Baer, 1997) might have triggered the core beliefs of some teachers that inquiry-based learning should be limited to a certain extent that would

not change current teacher's practice.

3 Teachers lack the technique to teach in inquiry-based approach

It has been found in the lesson observations of Fanny of school (A) and Peter of school (B) that both of them deliver the inquiry-based activities without providing necessary follow-up actions in their lessons that might enhance the features of inquiry-based learning. Logically, they got negative results when using the checklist of inquiry-based features to analyze their observed lessons. For examples, they seldom used inquiry language, encouraged collaboration, helped students to process information or encouraged high order thinking. Such an observation, to a certain extent, reflects that the teachers in the case were lack of training in leading the inquiry-based lessons. In fact, it has been shown in the literature review that other studies on primary school teachers have already alerted that teachers did not have the skills or experiences to teach through inquiry effectively (e.g. Crawford, 2000; Lederman & Niess, 2000). Further, PGS teachers have been requesting more training on practical teaching strategies in addition to a PGS Guide (So and others, 1999). Therefore, facing such a challenging new teaching method, fear might appear (French 2005). In other words, lack of training and skills in leading inquiry activities, become important contextual factor which influencing the formation of teacher's belief (Sigel, 1985) towards inquiry-based learning.

4. Students' ability and readiness

It has been found in the initial interviews that some teachers frankly admitted that they worried that if teachers allow students to inquire into knowledge by themselves, students may not know what to do and finally

they will not obtain necessary knowledge for further education. Fanny of school (A) also expressed such a viewpoint in the follow-up interview (section 9.3.3). During the initial interview, Sally of school (A) recalled that teachers should guide students step by step otherwise learning may not happen. David of school (A) also expressed that even though the principle is good it may be too early to implement it in Hong Kong, because local students are too passive in learning and parents are too traditional. On the other hand, it has been mentioned in different occasions (e.g. in initial interview and follow-up interview), Peter of school (B) raised his concern on the feasibility for junior level students to learn in inquiry-based approach, especially when the students have to engage in frequent group works and work independently. The worries of those teachers may not be psychological fears only. Although, Henry of school (A) and Alex of school (B) demonstrated effective inquiry-based lessons, they both disclosed in the follow-up interviews that, their students were not born with inquiry skills. Teachers had to cultivate such ability and learning habit through year's effort. In fact, it has been discussed in the literature review that local primary students may not have the readiness to learn in inquiry-based method (So and colleagues, 2005), and the more open the learning environment is, the more self-regulative students have to be, and the more they have to be instructional designers for themselves and it is not an easy job for them (Elen & Lowyck, 2000). Coupled with the situation observed in lessons, applying inquiry-based learning to primary students, especially in junior primary level (e.g. in Peter's lesson) may entail special requirement not only on teachers but on students as well. Hence students' ability and

readiness become other major concerns that may have hindered the positive beliefs of some teachers in inquiry-based learning.

5. Resources constraints

Teachers from the target schools have mentioned the problem of tight teaching schedule and not enough time to finish the pre-designed teaching content. The analysis of school documents confirms the concern. Further, during the lesson observations, the researcher also found that teachers were moving very fast from learning activities to learning activities. The tight teaching time also increase the pressure on teachers who have discipline problems in the class (e.g. Peter). Another resources problem is about the IT facilities. As it has been discussed, only teachers were found using IT resources during the lessons. No evidence found that students used IT frequently or easily. During the school visits and the lesson observations, the researcher found that there are one set of computer in each classroom and they are installed at the teachers' desks. Logically speaking, these computers should only be used by teachers. When IT solution become effective tools for self learning and inquiry, the lack of IT resources may has hindered the arrangement for students to engage in self or group learning through IT facilities. Certainly, there are resources problem other than computers, the number of lessons each teacher take (as mentioned by Fanny of school A), the number of students in each class, the limitation of space and facilities are all contributing to the formation of teacher's belief towards teaching methods that need extra preparation and resources, inquiry-based learning is an example.

In this study, the above-mentioned contextual factors may directly affected the formation of teachers' core beliefs and the perceived outcome of the

theory-in-action of the inquiry-based approach; therefore affect the implementation of inquiry-based learning in the PGS curriculum indirectly. They echo the literature about the challenges of adopting inquiry-based approaches (e.g. the five major challenges of Gordin, 1999, found in studying the use of visualization technologies to support inquiry-based learning).

On the other hand, there were also factors, affecting teachers' actions directly during the implementation of inquiry-based learning in the PGS. Some of those factors have been discussed in the literature review but some were discovered from this study.

10.4.2 Factors affecting the implementation: school administrative structure

As one of the discoveries that had not been explored in existing literatures, the administrative structure of the studied schools might have affected the implementation of inquiry-based learning in the PGS curriculum. It was intentionally designed to select two different schools as cases for comparison in this study because the researcher inferred that the characteristics of the schools should have contributed to different stories happen inside the schools.

In fact, one of the major characteristics of the schools that had affected the observed situation may be the schools' administrative structure. The school administrative structure and the policies thus generated define the roles teachers play in the target schools. Different administrative structures allow different degrees of freedom for teachers' actions. School (A) was selected because it was a traditional primary school (also see

section 4.1). The administrative structure of the school was described as traditional and bureaucratic. The senior staffs of the school issued a PGS handbook (in fact different handbooks for different subjects), which delineated what should be done and what should not. All PGS teachers in school (A) have to observe the handbook when teaching the PGS subject. As illustrated in the section about assessment and tight teaching schedule, one might see that teachers in school (A) were mainly governed by the policies of a unified teaching schedule and standardized examination content. Examples could be found in the case of Henry. Although he demonstrated effort in planning and delivering his lesson according to the inquiry-based principles, he still had to include certain non-inquiry practices in his lesson (e.g. helping students to study the textbook and giving fact recalling exercises). As he defended in the follow-up interview, he had to consider three aspects and one of them was the policy set out by the school administration (see section 9.2.2). Generally speaking, school (A) belongs to a centralized administrative structure according to Goerdel (2002), in which he described that teachers often find themselves removed from the decision making process.

In the case of school (B), since the school is famous for her progressive and open school administration, the researcher expected that the new PGS should be a very different story in that school. Actually, the school administration belongs to a relative open structure. In the case of the PGS subject, teachers were allowed to design their plans without much interference from the administration except that the school still adopted standardized examination to assess students in all subjects and all teachers have to observe that. Yet, according to the meeting minutes, PGS teachers in

school (B) successfully changed the proportion of marks allocation between formative assessment and summative assessment by increasing the marks for course works from 10% to 30% of the total marks. Thus, it is closer to a form of decentralization structure as described by O'Toole and Meier (2003) where front-line teachers are given more discretion.

Comparatively speaking, the relative decentralized structure of school (B) might have provided more room for her teachers in trying the new teaching method, while the relatively centralized structure of school (A) might have confined the autonomy of teachers in deciding the strategies in implementation of inquiry-based learning in the new PGS.

10.4.3 Factors affecting the implementation: the school culture

The study found another factor that has not been fully examined in the literatures about inquiry-based learning, the school culture. Deal and Kennedy (1982) defined organizational culture as "*the way things get done around here"* (p.7). School culture is widely defined as the background context that reflects the values, beliefs, norms, traditions, and rituals that build up over time as people in a school work together (Fullan, 2001; Peterson 1999; Hallinger & Leithwood, 1996; Dalin & Rolff, 1993; Hargreaves, 1995). School culture influences the actions of the school population, especially teachers in their motivations and spirit (Peterson, 1999). School culture also affects how problems are solved, the ways new ideas are implemented and how people will work together. Most important it can affect teachers' belief system and values and can make it change and adapt to the culture that is dominant in the school (Rosentholtz, 1991).

Using the criteria of Spahier & King (1984) (as cited in Butler & Dickson, 1987), the target schools could be evaluated as holding characteristics of different types of school culture. School (A) demonstrated the characteristics of the bureaucratic school culture as inside school (A); following features were detected.

- An administrator at the helm; teachers are followers of the dictated regimen.
- A strong emphasis on standardization, or following "the book", especially the handbooks for different subjects.
- Teachers work in isolation with little chance for interaction with peers.
- Policies are mandated from above, with little or no input from teachers.

On the other hand, characteristics of the collegial school culture could be found in school (B) as she demonstrated following features:

- Collegiality
- Experimentation
- High expectations
- Trust and confidence
- Involvement in decision making
- Protection of what's important
- Honest, open communication

The cultures of the two selected schools might have different effects on their teachers. When the schools have to face the new PGS curriculum, the teachers of school (A) looked less proactive and creative in trying the inquiry-based pedagogy. Some teachers might be driven by their own beliefs

(e.g. Henry) and performed proactively in the implementation of inquiry-based learning as prescribed in the curriculum and yet they could only do their best inside classrooms. It is their school culture and policy that important decisions (e.g. about the assessment, the direction of the curriculum development) were made by senior administrative staffs. The adoption of pre-packaged exercises and worksheets and the standard way for teachers to mark the assignment, in school (A) are examples. Henry defended that as the school administration require a uniformity of assignment policy, he just followed. On the other hand, the relative open or collegial culture of school (B) encouraged teachers to implement the new teaching method according to their own professional decisions or beliefs. Evidence could be found in their meeting minutes. Teachers of school (B) were empowered to discuss and decide how to improve the teaching and tackle the problems. Therefore, although some teachers might act according to their beliefs and thus became less devoted in following the inquiry-based principle at lessons (e.g. Peter), all PGS teachers worked as a team in designing positive measures to enhance students' inquiry-based learning. The suggestion of an on-line course of project learning was a typical example. Certainly it is also the influence of the sub-culture (Sherriton and Stern, 1997) of the PGS panel that made Peter of school (B) to carry on the inquiry-based approach in spite of the fact that he had to tackle great difficulty in students' discipline.

In short, the culture of the target schools may have influenced teachers' practice in inquiry-based learning. Such analysis echoes the findings of Ross (1979). Especially when Ross found that the perceived connections between beliefs and practices and perception about the beliefs of school system

officials are major factors influence teachers' ability to practice based on their beliefs.

10.4.4 other factors

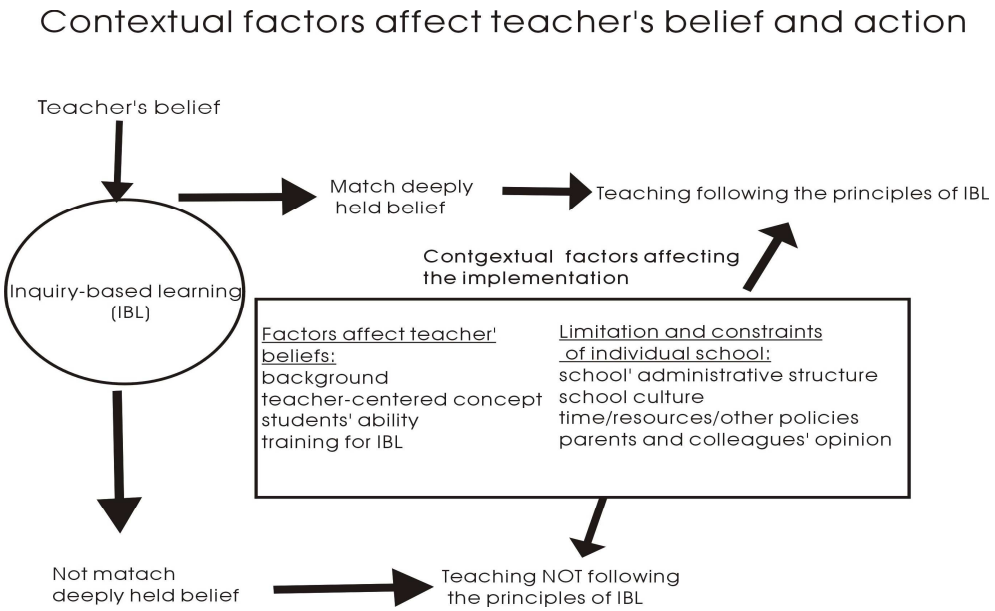
As discussed in the literature review, in Hong Kong, other than teachers' belief, there are many factors exerting powerful influence on the pedagogy used (Morris, 1995). In fact, some of the factors discovered by Morris were also detected in this study. For examples all teachers expressed their concern on examination and resources constraints (especially teaching time). In addition to the two major factors discussed above (the school administration and school culture), extra contextual factors may also be added to the list. They are, first, the viewpoints of parents. As expressed by some teachers in the initial interviews and the follow-up interview, parents' readiness in accepting a new learning approach, directly affect the extent teachers adopt the approach. Second, practices of other teachers would also exert peer pressure on teachers' choices. For example, the conventional practices of colleagues in school (A), is one of the three major concerns mentioned by Henry in the follow-up interview. Third, the influence of adopting standardized teaching materials. Especially the textbooks and other materials prepared by the textbook publishers. As discussed, the PGS textbooks are mainly reading materials with fixed answers and content, to a certain extent, it restricted students' inquiry and teachers' interpretation of student's answers.

10.4.5 A conclusion of the sub question (3)

Referring to Sigel's (1985) components of belief, the above-mentioned

contextual factors may have influenced the formation of teachers' beliefs of relevant schools, especially when teachers face a new and uncertain change in curriculum and pedagogy. Such factors may lead to positive or negative belief towards the new teaching method. In addition to that, some contextual factors may also exercise their effects in two opposite directions. In a positive direction, if the contextual factors favour the change in teaching and learning method, the change may be facilitated, for example, in school (B) parents tend to trust the teachers in adopting suitable teaching methods and thus teachers were easier to bring in the changes. On the contrary, if the contextual factors do not favour the change, those factors may become constraints or limitation, the culture in school (A) is an example in this aspect.

Figure(10.3) Contextual factors affecting the implementation of inquiry-based learning



10.5 What are the different impacts of teachers' beliefs on the implementation of inquiry-based learning in the two schools with different background?(Sub question 4)

The two target schools were selected because of their unique background. The research found that teachers' beliefs in inquiry-based learning and the way teachers treated the new PGS were also different in the two target schools under study. Different schools with variation in background, are having different influence in implementation of inquiry-based learning in the PGS, the following explains this aspect.

As mentioned, in school (A), although the written policy as revealed from the PGS handbook of school (A) seemed to show the supportive standpoint in inquiry-based learning, their design of assignments, grading criteria and their heavy reliance on the standardized tests and the pre-packaged worksheets and workbooks, may create a less favourable environment for the implementation of the new pedagogy. In fact, the follow-up interview of teachers from school (A) told their stories. The constraints imposed by the tradition, policy and culture of school (A), discouraged teachers from trying the new child-centred teaching method. School (A) was described as a traditional one (see section 4.1). The background of the school may have contributed to the centralized structure in the school administration. Therefore, the school (school A) with a centralized administrative structure and bureaucratic school culture may have imposed greater constraint on teachers' autonomy during the implementation of a new teaching method. Hence, the development of the inquiry-based approach and the new PGS curriculum may be mainly affected by the beliefs of the school administrative staffs, instead of the beliefs of the PGS teachers. As discussed in the literature review, traditional local primary classroom emphasize

teacher-centred pedagogy (Morris & Marsh 1991). When transmission of knowledge and maintaining classroom order and efficiency are still the major concerns of local schools (Lee &Gerber, 1996; Lee & Dimmock, 1998), a school of traditional centralized structure logically give less support to a student-centred teaching method.

In addition to the conservative belief of the school administration and the conservative policy, parents' background and viewpoint should not be neglected. Since in school (A), most parents come from middle class families, teachers faced greater challenge when changing the assessment and teaching method from a traditional summative assessment and a "results-come-first" concept to a formative assessment and a process orientated teaching method.

Nevertheless, in school (A), teachers still possess certain freedom in deciding how to implement inquiry-based learning in their classrooms. The positive performance of Henry was an example. It seems that, inside school (A), teachers' beliefs exercised their effects mainly on teacher's personal preparation, teaching and informal evaluation of student's learning rather than on the policies and decisions of planning, delivery and evaluating of the curriculum.

On the other hand, the standpoint in inquiry-based learning of school (B) was established in the PGS panel meetings. Inside the meetings, all teachers (include Peter who was found carrying negative personal belief in inquiry-based learning) supported the adoption of an inquiry-based approach and they also discussed policies that might facilitate the implementation of inquiry-based learning. The results of analyzing students' work also show that the policies and styles of assessment demonstrated more features that facilitating inquiry-based learning when comparing to school (A). The

planning of curriculum, the policy in assessing students and the actual results of students works all demonstrate a relative inquiry favourable environment. Although standardized test and pre-packaged materials were also used in school (B), the teachers instead of the school administration decided the importance and usage of such tools. In other words, the teachers of school (B) possessed more autonomy in adjusting the curriculum and designing measures to improve students' inquiry-based learning (as reflected from the analysis of student works and schools' documents). Therefore, when the teachers of school (B) held more positive beliefs in the principles of inquiry-based learning, they came up with more positive measures in developing the new PGS at school to make it more inquiry-based. Such autonomy not only applies to the decision of what to teach and how to teach in lesson, but also applies to the planning for implementing the inquiry-based activities, assessment of student's learning, the usage of standardized test and pre-packaged materials, the extra-curricular activities and the evaluation and improvement of the curriculum in a school-based level. As discussed earlier, school (B) is described as a progressive school (see section 4.2). The mission of the school and the beliefs of its managing body may have contributed to its collegial culture and decentralized administrative structure. Such collegial school culture and decentralized administrative structure provided greater room for teachers to implement and develop the new PGS curriculum according to teachers' beliefs. The panel meeting minutes showed that consensus was reached when teachers were discussing measures to facilitate inquiry-based learning. Hence, relative positive teaches' beliefs of school (B) helped developing the new PGS in inquiry-based direction. Further, most parents of this school come from working class. They tended to rely on

teachers' professional practices instead of putting pressure on teachers to implement specific teaching method.

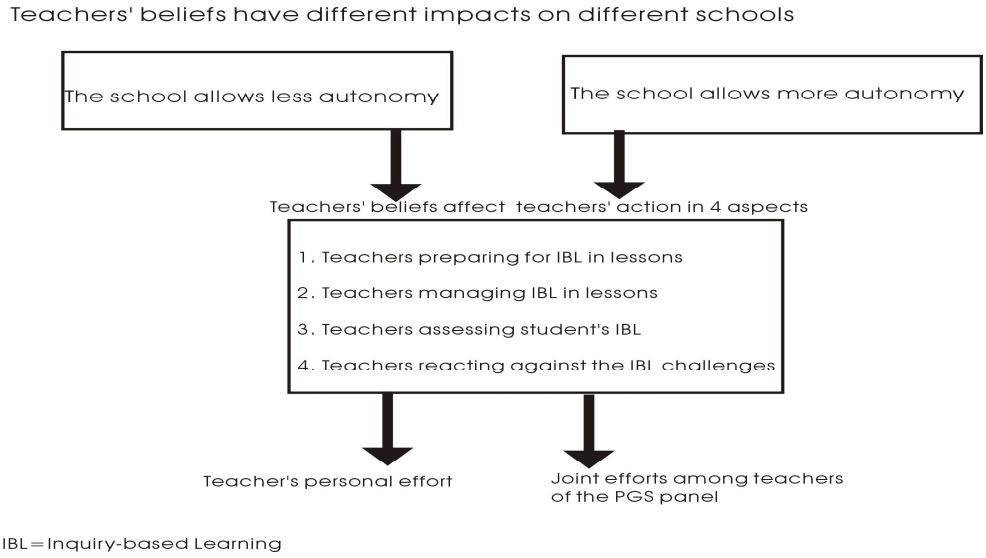
When comparing the results of sub question 2 and 3, one interesting point could be reached. It has been found that the impact of teachers' beliefs on the implementation of inquiry-based learning in the new PGS could be seen in four aspects, namely the impact on teacher's preparation of the lessons, teachers' management of the lesson, teachers' assessment of students and teachers' reaction against challenges. Nevertheless, in school (A), teacher's planning and preparation of the lessons is limited to the practical preparation of individual lesson only, while in school (B), such planning extends to the preparation of the whole curriculum implementation process. In school (A), teacher's belief affects a teacher's management of his own lesson, while in school (B) the beliefs of the teachers in the panel affect the whole delivery of the curriculum in the school. In the aspect of assessing student's learning, it has been discussed that the impact of teacher's personal belief was not obvious in formal assessment policy. In fact, the relative conservative feature of school (A) imposed some conservative measures on her formal assessment of student's learning. In school (B), the school is relatively open in structure and collegial in culture. The formal assessment policy was in fact the common decision among the relevant teachers. Similarly, in school (A), teachers' reaction to challenges may only apply to teacher's personal attitude and action against the challenges one faced. In school (B), the reaction of challenges not only applies to teacher's personal reaction, but also applies to the discussion inside the subject panel and decision made to adjust the curriculum.

10.5.1 A conclusion of the sub question (4)

Therefore, the finding analysed for sub question 4 supplement the discussion of sub question 2 and 3, in the way that, the impact of teachers' beliefs on the implementation of inquiry-based learning must take into account the contextual difference of individual schools. In answering sub question 3, it has been found that the impact of teachers' beliefs and the effect of other contextual factors interacting with each other in exercising influence on the implementation of inquiry-based learning in the new PGS curriculum. The studied cases revealed some valuable points on such interaction (also see figure 10.3).

As a conclusion of comparing the two target schools, the contextual features of individual school seem to have influence on the implementation of inquiry-based learning in the new PGS curriculum. Figure (10.4) explains such a viewpoint. As the school allows less autonomy for teachers, teachers' belief may only affect teacher's personal preparation works, lesson management and informal assessment in the inquiry-based lessons. On the contrary, when the school allows more autonomy for teachers, the impact of teachers' belief may extend to the planning of the inquiry-based curriculum, the way of delivering the inquiry-based lesson and the formal assessment policy. Similarly, in a school, which allows less autonomy for teachers, the reaction to challenges by teachers is the personal reaction only, while in an empowerment school, the reaction to challenges may be in the form of joint effort, collaboration and mutual support.

Figure (10.4) Different impacts of teacher's belief in different schools



10.6 A summary of the discussion

It has been discussed in this chapter that there are evidences indicating that various teachers' beliefs affected teachers' decisions and actions in the implementation of the inquiry-based learning approach. However, such effects were adjusted and influenced by other contextual factors. However, the scope of such adjustment depends on the school's structure. In school with centralized power structure, teachers' beliefs may exercise greater influence in classroom teaching, while other factors of individual school may have greater impact in adjusting the planning and assessment process of the official curriculum. On the other hand, in a school that allows more autonomy for teachers to handle the new curriculum, teachers' beliefs may exert greater impact on different aspects of the implementation.

The answers to the sub questions of the research also provide evidence and insights to the theoretical framework. First, it was found from the literature that the applicability and effectiveness of the inquiry-based

learning approach entail great challenges due to its special pedagogical requirement and various contextual constraints in schools. The findings of the factors that affecting teacher's belief towards inquiry-based learning, not only confirm such challenges, but also disclose in detail that, the special pedagogical requirement of the inquiry-based learning, directly affect teacher's belief formation while the contextual constraints of individual school exerting its influencing indirectly on teacher's belief and teacher's actions.

Second, as mentioned in the theoretical framework, Sigel' s components of beliefs provide a framework for us to analyse the various aspects of teacher's belief and it has been quoted from various literatures that teacher's belief affect teacher' choice of teaching method. The present study found that teachers' belief components are interrelated. The answers to sub question one show that it is not the question of "believe or not" or "what do teachers believe" only, the ultimate action of a teacher is determined by the interaction of "believe what" (core belief), "belief how" (belief about praxis), "is the belief strong enough to drive action" (have the core belief or belief about praxis developed into theory-in-action), "how confident the teacher has towards the belief" (the perceived outcome of the theory) and "what factors influencing teachers' belief" (the contextual influence). In addition, teachers' belief are affecting different stages of the implementation of inquiry-based learning, namely, the planning, the delivery and assessing of learning and the reaction teacher adopted against the challenges, although the extent of such impacts in these stages varies according to the contextual features of individual school.

Chapter 11

Conclusion of the study

11.1 How do PGS teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum? (The research question)

Responding to the research question, the present study found that teachers' beliefs might have impacts on different aspects of the implementation of inquiry-based learning in the PGS curriculum in the target schools.

First, it has been found in the case that teachers are carrying different core beliefs and belief about praxis towards teacher's role, student's role, teaching and learning and how to teach in inquiry way. Moreover, teachers' beliefs in inquiry-based learning manifest at different levels. As discussed, many of the target teachers verbally believed that inquiry-based learning is something good and in the correct direction of the educational trend. However, when going into the detail content of inquiry-based learning, especially the constructivist view of constructing knowledge by learner and teacher as the facilitator, teachers' beliefs became diverse. Some teachers still accepted the root principles of inquiry-based learning and interpreted inquiry-based learning according to such principles. Yet, others held different reservations and retained their own interpretations for inquiry-based learning. In other words, some teachers believe that inquiry-based learning has its "value in theory" but not "value in practice". Furthermore, some teachers who expressed agreement on the basic principles of inquiry-based learning added their own interpretations in the follow-up interviews after

their lesson being observed. The above-mentioned findings elaborate the theoretical framework that teachers' beliefs and actions are inevitably mediated by contextual variables (e.g. Bennis, Bene & Chin 1985; Clark & Peterson, 1986) and due to such mediation, teachers not always act according to their claimed beliefs.

Second, the study also unveiled that teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum in following aspects:

1. Teacher's attitude in preparing the lesson to facilitate inquiry-based learning.
2. Teacher's attitude and strategies in managing the lessons and facilitate inquiry-based learning
3. Teacher's attitude and strategies in assessing student's inquiry-based learning
4. The way teachers react to challenges that are brought about by inquiry-based learning.

Nevertheless, the depth and scope of such impacts depend very much on the contextual features of individual school. In a school where the decision about teaching and learning approaches used is in the hands of school administrations instead of individual teacher, the decisions in planning, managing and assessing of the pedagogies used are, to a greater extent, influenced by the school administration, rather than teachers' own beliefs. Yet, teachers still possessed autonomy in personal preparation of each lesson, managing the learning activities and teaching methods in his own lessons, assessing students informally during the lessons and make personal reaction towards the challenges arose from implementing inquiry-based

approach. School (A) in the study is an example of such a situation. On the other hand, in the school that allows more empowerment for teachers, teachers' beliefs play a more important role in the planning, delivering and evaluating of the teaching and learning methods adopted. Under such circumstance, common beliefs of the teachers inside the subject panel may also lead to collective actions to tackle the challenges during the implementation of inquiry-based learning. School (B) is an example.

Third, it has also been found that there are two types of effect concerning the contextual factors that have impacts on teachers when they implement inquiry-based learning. First, the direct effect, some contextual factors (e.g. resources constraints and conventional practices of the school) contribute to the formation of teachers' belief about the issue. In the study, the factors such as adopting the standardized test and the tight teaching schedule caused some teachers (e.g. Fanny in school A) to believe that inquiry-based learning is time and effort consuming and bring extra workload to teachers and yet fail to benefit students' academic achievement. Other contextual situation (e.g. the empowerment culture of school B) contributes to the formation of some teachers' belief that inquiry-based learning worth trying and putting effort in it (e.g. Henry of school A). Such contextual influence in teachers' belief formation can be explained with theories about belief formation of Sigel (1985) and O'Loughlin (1986).

Another type of effect is that when teachers try out a new teaching method or a new curriculum, some contextual variables indirectly affect teacher's choice of action. In this study, the administrative structure of the school and the school culture or conventional practices of colleagues are typical examples of such kind of factors that have hindered or facilitated

teachers' choices of actions during the implementation of the inquiry-based approach.

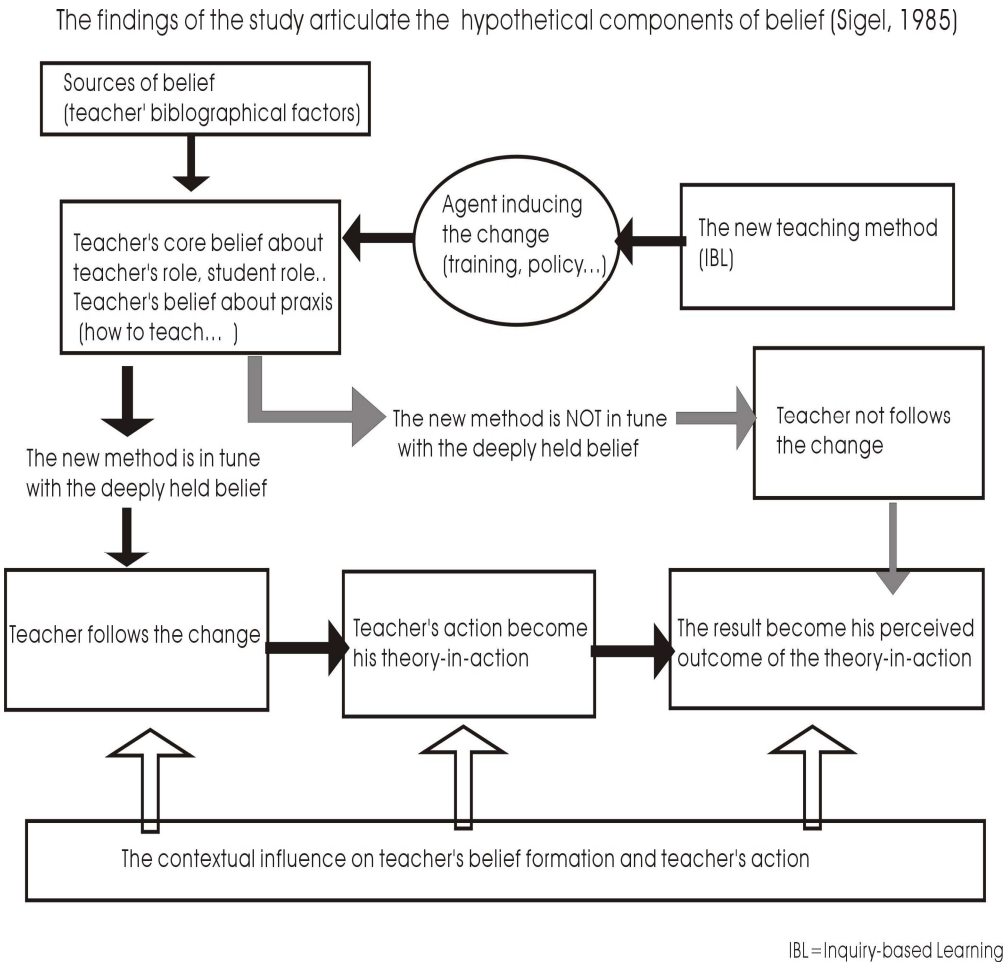
As a result, the above-mentioned conclusions articulate the theoretical framework that, there are evidence that teachers' beliefs have different impacts on teachers' implementation of the inquiry-based learning and the contextual factors of individual schools are critical to the depth and scope of such impacts. In addition, an important theoretical finding is that when Sigel (1985) invented the hypothetical components of belief and O'Loughlin (1986) interpreted the components in terms of the studying focuses of teacher's belief, the present study provides an authentic example of the function and interrelationship of the components. As discussed in section 10, teachers' ultimate actions, especially when they face a requirement of change of teaching method, are the result of the following interrelationship.

Whether a teacher changes to a new teaching method or not, may be the result of the interaction of the level and firmness of core belief and belief about praxis a teacher holds (about teacher' role, student's role, teaching and learning), against the effectiveness of the agent that inducing the change (the training from the authority and the policy of the individual school) and the direction of the contextual influences on teacher's belief formation (whether it favour the adoption of the new approach).

Furthermore, when a teacher believe in the new approach and act according to it, the new theory become his implicit theory of action and the results he obtains become the outcome of the new theory. In this study, when Henry and Alex believed in the value of inquiry-based learning, they therefore tried their best to facilitate inquiry-based learning in their lessons, under different contextual constraints, they demonstrated their

theory-in-action about inquiry-based learning and as a result, they saw positive outcome of the theories (after year's effort). Figure (11.1) illustrate such a relationship.

Figure (11.1) The findings of the study VS the hypothetical components of Sigel(1985)



11.2 Other findings

During the study, the researcher adopted a developing method and the Constant Comparative Approach. Therefore, each step of the study or each data collecting procedure entailed additional focuses or questions for the coming procedures. Under such strategy, following additional concerns have been raised and followed up:

1. Did teachers only practice inquiry-based approach on science content?

   Once the researcher suspected that teachers of school (B) might only apply inquiry-based learning on science related content, yet, the analysis of students' works and the lesson observations confirmed that it was not the case. Teachers under study intended to practice inquiry-based learning in all kinds of content as prescribed in the PGS curriculum. The lesson observation also showed that inquiry approach also works in non-science topics.

2. Since teachers from both schools mentioned, in the initial interviews, the use of IT to help their teaching, the researcher added such a focus to the procedures of documentary analysis, studies of students' works and lesson observation. Finally, the result shows that IT did help some teachers to deliver their lessons more effectively, yet, the use of IT in the target schools were limited to teachers only. There was no evidence showing that students use IT to help inquiry-based learning.

3. Tight teaching schedule and difficulties in assessing students' inquiry were the two major challenges mentioned by teachers under studied. Hence, the researcher paid special attention to relevant evidence. Finally, evidence from the follow-up interviews and the analysis of students' works confirmed such concerns, although the scope of impacts varied according to the situations of different schools.

4. The researcher once suspected the effectiveness of inquiry-based learning as applied on junior level students. As the case of Peter of school (B) revealed, there was not strong evidence showing that inquiry-based learning is not suitable for young students. Rather, it has been found that the belief or the predication that young students were

not ready for inquiry entailed self-fulfilling prophecy effect of the teacher and thus hindered the willingness to try out inquiry-based methods.

5. Last but not the least; the researcher thought that the story of compromise was a major discovery of this study. As discussed in the literature review, Sliberman and others (1972) reminded that there are broad strategies and special tactics that help to make inquiry more productive. They further pointed out that there is no one fixed method of operation. On the other hand, Schwartz and colleagues (Schwartz & Bransford, 1998; Schwartz &Martin, 2004) claimed that there is a place for both direct instruction and student-directed inquiry. In this study, one common story all teachers told was the necessary of combining some direct teaching methods into the inquiry-based approach. Such strategy was adopted in responding to various needs and reasons.

11.3 Implication and recommendation

The most important finding of the present study is the importance of teacher's belief in implementing a new teaching method, especially when teachers are facing requirement for changing their daily practice in the classrooms. Such a finding may be simply a reminder for teachers to reflect on their own beliefs and the importance of their beliefs. As the present study revealed, teachers sometimes do not even notice their own core beliefs towards their daily practices or the people they serve. As teachers rethink frequently the questions "what am I believe?" and "how do such belief come from?" we may easily discover that some of our beliefs may not be evidence-grounded. As Sigel (1985) reminded those

non-evidence-grounded beliefs are more difficult to change, because they address our emotion, rather than our reasoning. Therefore, the reflection of beliefs may help teachers to open their mind and break down the wall between them and the choice of teaching methods.

The study also revealed that school administrative structure, school culture, parents' viewpoints, adoption of standardized teaching materials (i.e. textbook), examination, resources and readiness of children were contextual factors influencing teachers' decisions and actions. They were forces interacting with teachers' beliefs in generating final teaching behaviour. Therefore, each of these areas should be studied carefully, in order to draw a whole picture for the preparation and support for adopting inquiry-based learning in local classrooms. It on the other hand, provides reference for school administrators when leading the curriculum change especially for inquiry-based curriculum. On one hand, they have to take into consideration the unique features and contextual factors of their own schools and adjust the official curriculum to meet the needs of students and teachers. For examples, the school administrators should be altered with the contradiction of using traditional assessment tools to evaluate student's inquiry-based learning. As discussed, the standardized examination, especially those heavily relying on textbook content, created major difficulty for teachers to adopt inquiry approach. In addition, as a management of curriculum change, school administrators should not overlook the importance of educating teachers and influencing their belief formation. Otherwise, only relying on new administrative measures, changes in classrooms may be minimal.

In the aspect of feedback to the authority, several suggestions may be

useful. Such suggestions include the administration aspect, the preparing of teachers and students and the change in system of curriculum decision making.

In the administration aspect, as the present study revealed, contextual constraints, especially about the limitation of resources, have affected teachers' motivation and actual action in adopting inquiry-based approach. Since inquiry-based activities require teachers more time to prepare and those activities need more time to finish as comparing to traditional teachers' lecturing, the adoption of inquiry-based curriculum must come along with the adjustment of the amount of curriculum content and teaching time. The authority and the school administration should not expect teachers to cover the same amount of curriculum content by using the same amount of teaching time but only altering the teaching approach from traditional teachers' lecturing to inquiry-based learning.

In addition to the problem of teaching time, teacher-student ratio is another major consideration. Since leading an inquiry-based lesson takes teachers more effort in facilitating individual students' inquiry, the teacher-student ratio needed to be adjusted. One year ago local government announced the small class policy by decreasing the number of students in a class from 35 to 25 (Hong Kong Annual Report, 2008), it is in the favourable direction for adopting inquiry-based approach, yet, for some junior level students, as in the case of Peter of school (B), less than 25 students in a class may be more appropriate. Following this consideration may be the problem of space and physical facilities. Students need more space for group activities and they also need more computers and other tools for scientific experiments. Certainly, the wish list is also a list for financial

budget that the government has to take care. In other words, altering a new teaching method in schools by any means cost capital.

In the aspect of preparing teachers and students, the government should fully understand the importance of teacher's belief, especially the deeply held core belief about the roles of teacher and students and the belief about praxis in leading an effective lesson. During the initial interview, the researcher even found that some of the teachers were carrying negative or very low expectation towards inquiry-based learning. It reminds the findings that teacher-centered belief is prevailing in Hong Kong schools (Morris, 1998); much more education and in-services training for promoting inquiry-based strategies are needed if the government plans to head for inquiry-based curricula. These training at least cover following areas:

First, the orientation section, it includes the introduction of the rationales for inquiry-based approach, the existing common practices and procedures of an inquiry-based lesson, the pedagogical requirements of inquiry-based learning to teachers and to students.

Second, the in-services section, since observing other colleagues doing is one of the crucial sources of belief formation for new teachers, the government has to provide more positive examples in inquiry-based methods for teachers. By placing outside effective teachers in different schools as role models may help exposing ordinary teachers for inquiry-based teaching method.

The preparation works should not neglect the most important role in the new approach, the students. It is not only teachers need training, but also students. Special training about the skills and requirements in inquiry should be provided to students before the kick off of the actual inquiry-based

curriculum.

In the aspect of changing the system of curriculum decision making, following recommendation may help. When referring to the contextual features of local macro educational environment, as the literature review disclosed (Morris 1998), in Hong Kong, curriculum of all subjects are decided and written by the CDC of the government. When the government adopts a centralized decision making, the scope for curriculum development left for school and teachers sometimes become very narrow (e.g. in the case of school A). In fact, Shkedi (2006) warns, when curriculum is developed and written at the school level, the place of the teachers in the curriculum development process is guaranteed. When curricula are written outside the school setting, the role of the teacher in the curriculum-development process becomes an issue. The researcher suggest not only more consultation before the innovation of a new curriculum or a new teaching method, but also reserving more room for school-based or even class-based decision concerning the amount of teaching content and the pedagogical used. In fact, this study shed light on one important issue that effective strategies should be school based and students-centered, hence it is not a matter of employing which type of teaching method; it is the matter of selecting tools for students with different abilities and aptitudes. Therefore it is reasonable for the authority to reflect on the rationales of defending or supporting specific type of teaching method for specific discipline. It is at the end the responsibility and right of teachers.

Fullan (2001) said that over the last four decades most innovative curriculum projects have failed to bring about significant change. Innovations were adopted on the surface, with some language and structures

being altered, but the practice of teaching remained essentially unchanged. The result of this study, to a certain extent, echoes what Fullan saw. As illustrated in figure (11.1), the present study found that no matter what the authority recommended, the decision of following the change or not is still deeply affected by teachers' existing core beliefs and belief about praxis. It confirms what we discussed in the literature review as Korthagen & Kessels, (1999) found that the ultimate decision of teachers' actions is determined by teacher's belief. As any innovation would encounter difficulties, inquiry-based learning is not an exception. Yet, positive teachers' beliefs helped some teachers to overcome the difficulties and solve the problem creatively. Therefore, before asking all PGS teachers to implement inquiry-based approach, more and deeper education and training is a must for the teachers. Once there is an effective agent that inducing the change, it is possible to change the core beliefs of the teachers and when the basic belief change, the behaviour follows.

11.4 Limitation of the study

The research was a qualitative case study with its focus mainly on teachers' belief and its effects on inquiry-based learning in PGS subject in local classroom. It has dug out interesting stories and inspiring content. Certainly, there are limitations in this study. As a single researcher project, the adoption of data collecting procedures, the extent of investigation and the number of people being studied have to be limited according to the resources, time and physical energy of the researcher. There were totally 8 teachers in two schools being investigated. 4 teachers were investigated in more detail. As a better arrangement the researcher should also inquire the

side of students. In fact, it was the original plan to deliver a focus group discussion to the observed students. However, the researcher had to respect the concern of the school administrations for arranging group discussion to their children by outsider. As a result it became another limitation of this study that student' aspect has not been explored properly.

11.5 A closing remark

Early in 1982, the Llewellyn Panel (1982) reported that primary schooling in Hong Kong was characterized by very formal teaching, teacher resistant to innovation, and a subject-centered rather than child-centered culture was prevailing over Hong Kong. Nevertheless, what the researcher saw was a picture of hope and new strength. Some of the teachers in the primary classroom under study were professional and responsible. The study has at least brought out stories of how some of the PGS teachers struggling to fulfill the needs of the students. Lister & Leaney (2003) noted; a good teacher is neither a complete constructivist nor complete objectivist. A good teacher is responsive to the needs of their students.

The End

Appendix (1) Questions for the initial interview

(Chinese to English translation version)

Topic: *How do teachers' beliefs affect the implementation of inquiry-based learning in the PGS curriculum?*

(Lead-in questions)

1. Which level of Primary General Studies (PGS) do you teach?

2. How many classes of PGS do you teach?

(From PGS to inquiry-based learning)

3. Have you ever taught the old PGS syllabus (the one before 2004)?

4. In your opinion, what are the biggest difference between the new PGS and the old one?

5. Have you noticed the term "inquiry-based learning" in the Guideline of the new PGS ?

(Teachers' belief on inquiry-based learning)

6. How do you interpret the following explanation of "inquiry-based learning" as quoted from the new PGS Guideline?

(A) "In the inquiry process, students are active constructors of knowledge and the teacher is a facilitator of learning. Instead of the teacher giving the right answers, students have to raise questions, find their own answers and look for the necessary information"

(B) "Inquiry is not so much seeking the right answer ─ because sometimes there is none ─ but rather, seeking appropriate solutions to problems." (4.2 PGS Guideline 2004)

7. In your opinion what kind of teaching strategies should a teacher use in order to implement the inquiry-based learning principle in PGS?

8. In your opinion how should the student learn or behave in an inquiry-based learning PGS lesson?

(Teachers' actual implementation of the inquiry-based learning curriculum)

9. In your actual experience what have you done in teaching strategies in order to deliver the PGS lesson according to the inquiry-based lesson principle?
10. In your actual experience, what have you done in extra curricular activities, in order to promote students' inquiry- based learning?

(Effect of the inquiry-based learning lesson)

11. In your experience, what have the students actually changed in their learning behaviour in the PGS lesson since the implementation of the new PGS?
12. In your experience what are the benefits of inquiry-based learning to students ?
13. In your experience what are the challenges of inquiry-based learning?

(Discrepancies between belief and reality /theory and practice)

14. How do these experience differ form your expectation on inquiry-based learning?
15. What factors contribute to such difference?

(Counter check belief on inquiry-based learning)

16. Generally speaking, do you support the inquiry-base learning principle? Why?
17. Do you think inquiry-base learning suitable for local students?

(Background of the teachers being interviewed)

18. Have you received any pre services training on teaching PGS? WHEN? WHERE?
19. Have you taken any in-services training on teaching PGS? WHEN? WHERE?
20. Which major subject did you take in university or college of education?
21. Which area of subjects did you take in secondary education? Science strand? Humanity strand? Commerce and business strand? (In Hong Kong senior secondary education used to be divided into these three strands until 2009)

THANK YOU FOR YOUR COOPERATION

Wordings in blue are added by the researcher for explaining the function of the questions only, they did not appear in the Chinese version

Appendix (2) Checklist for the school document analysis

(Chinese to English translation version)

School _____
Date of reading the document_____

1. Description of the school document

- The type of document

_____
_____

- The purpose of the document

_____
_____

- The category of the document

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- The content of the document

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2. Have the schools prepared for the inquiry-based learning?
(Exline ,1995 the proper planning for inquiry-based lessons)

1. plan ways for encouraging learners to engage in the learning process

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2. plan ways to encourage learners to take increasing responsibility for his learning

_____

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_____

3. ensure that classroom learning is focused on relevant and applicable outcomes

_____

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_____

4. prepare the classroom environment with the necessary learning tools, materials, and resources for active involvement of the learner

_____

_____

_____

5. Set content learning in a conceptual framework, stress skill development

and nurture the development of habits of mind

6. Make student assessment an ongoing part of the facilitation of the learning process

3. Information for answering the queries emerged from the findings of the initial interviews.

- Teachers' belief or schools' belief?

- information in non-science inquiry

- The role of Information Technology (IT)

- The major challenges of inquiry-based learning

4. **Follow-up questions emerged from the school document**

Appendix (3) Checklist for the students' works analysis

School _____

Date of reading the works_____

Class of the student_____

Teacher _____

1.Description of the works

- The type of works

_____

_____

_____

- The purpose of the works

_____

_____

_____

- Teacher's marking

_____

_____

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_____

_____

2. Do students' works demonstrate inquiry-based learning?

(clues of the 9 principles of Grotzer (1996) in output demonstrating inquiry-based learning)

1. Children construct understanding and knowledge through experiential learning and their own questions but the process is mediated by adults.

_____

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2. Question-asking is invited.

3. Mistakes are valued for the learning they provide and as natural parts of inquiry process.

4. Open ended questions are asked and appreciated.

5. There is more than one possible answer.

6. Theorizing and considering evidence is considered more important than a "right answer".

7. Sometimes questions are asked and not answered.

8. All ideas are welcome to share.

9. Ideas are discussed for their explanatory potential, ability to solve the problem, and the thinking that they inspire as opposed to being called “good” or “bad” , “right” or “wrong”.

3. Teachers' beliefs as shown in students' work

4. Information for answering the queries emerged from the findings of the initial interviews and analysis of school documents.

- Teachers' belief as indicated in students' work

- What are teachers' roles

- Do teachers emphasizes the "right answer"

- The problem of assessment

- The use of IT

- The non-science inquiry

- The works of junior level students

- Did teachers follow school policies?

5. Follow-up questions emerged from the students' works analysis

Appendix (4) Checklist for the lesson observation

The first 13 items are designed according to Drayton and Falk (2001), when they found that classrooms where teachers emphasize inquiry-based learning have the following characteristics (Drayton & Falk, 2001):

1• Inquiry is in the form of authentic (real-life) problems within the context of the curriculum and/or community.

always ❑ occasionally ❑ never ❑

note_____

2• The inquiry capitalizes on student curiosity.

always ❑ occasionally ❑ never ❑

note_____

3• Data and information are actively used, interpreted, refined, digested and discussed.

always ❑ occasionally ❑ never ❑

note_____

4• Teachers and students collaborate.

always ❑ occasionally ❑ never ❑

note_____

5• Community and society are connected with the inquiry.

always ❑ occasionally ❑ never ❑

note_____

6• The teacher models the behaviour of inquirer.

always ❑ occasionally ❑ never ❑

note_____

7• The teacher uses the language of inquiry on an ongoing basis.

always ❑ occasionally ❑ never ❑

note_____

8• Students take ownership of their learning.

always ❑ occasionally ❑ never ❑

note_____

9• The teacher facilitates the process of gathering and presenting information.

always ❑ occasionally ❑ never ❑

note_____

10• The teacher and students use technology to advance inquiry.

always ❑ occasionally ❑ never ❑

note_____

11• The teacher embraces inquiry as both content and pedagogy.

always ❑ occasionally ❑ never ❑

note_____

12• The teacher and students interact more frequently and more actively than

during traditional teaching.

always ❑ occasionally ❑ never ❑

note_____

13. There is an identifiable time for inquiry-based learning.

always ❑ occasionally ❑ never ❑

note_____

The items 14 to 17 are designed according to the criteria of Exline (2004).

Joe Exline (2004). Lists out the following criteria which could be used to see whether the teacher facilitates classroom inquiry-based learning

14. The teacher asks questions, encouraging divergent thinking that leads to more questions.

always ❑ occasionally ❑ never ❑

note_____

15. The teacher values and encourages responses and, when these responses convey misconceptions, effectively explore the causes and appropriately guide the learner.

always ❑ occasionally ❑ never ❑

note_____

16. The teacher is constantly alert to learning obstacles and guides

learners when necessary.

always ❑ occasionally ❑ never ❑

note_____

17. The teacher asks many Why? How do you know? And What is the evidence? type of questions.

always ❑ occasionally ❑ never ❑

note_____

Others findings

_____

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Appendix (5) Questions for the follow-up interviews

(Chinese to English translation version)

Teacher's name_____
School _____
Reason for
selection_____
_____

1. Teacher's comment on the observed record:

_____
_____
_____
_____
_____
_____
_____
_____

2. Follow-up questions

Questions for Henry

1. *In the initial interview, you said that teacher should only provide an environment which foster students' inquiry without giving them too much instruction. Do you think you have acted according to your belief?*

2. *What is the key for training students to be co-operative and proactive in an inquiry-based lesson?*

3. *Do you think examination limits your freedom in handling the inquiry-based curriculum?*

4. *Can you clarify the arrangement for students to use IT resources at school?*

Questions for Fanny

1. *As you have indicated in the initial interview that you think inquiry-based learning is good for students and yet teachers must provide ample instruction and background information and you also disagree that 'inquiry is not about seeking the right answer'. Do you think your actions in the observed lesson were in conformity with your beliefs?*

2. *Have you noticed that some students were talking irrelevant things in the group discussion, teasing other students who were doing the role-plays and showing annoying when teacher was lecturing?*

3. *It gave me an impression that you cared about the model answers very much. Have I observed correctly? Does it relate to the strategies you assess the students in the PGS lessons?*

4. *As you have disclosed in the initial interview that teaching time is the major challenge for you, do you mean the situation as observed at the lesson?*

5. *Can you tell me more about your experience in using IT at PGS lessons?*

Questions for Alex

1. *Do you think your performance in the observed lesson was in consistent with your belief in inquiry-based learning?*

2. *Can you tell me more about your preparation in designing inquiry-based activities for the observed lesson?*

3. *Can you tell me more about how did you build up the productive class routine?*

4. *When I observed your lesson, I found that you were also observing your students during the group discussion section. Did you assess them for their performance in group-works or in the process of the inquiry?*

5. Can you share with me the situation of using IT at your lesson?

Questions for Peter

1. Can you comment whether your behaviour in the observed lesson reflected your beliefs in inquiry-based learning?

2. Can you tell me more about the background of the observed students?

3. What is your comment the relationship between inquiry-based learning and the discipline problem of the observed students?

4. I noticed that the you seemed to have no time to assess the students during the lesson, do you agree?

5. I noticed that you did not use any IT facilities at the lesson, can you explain your reason?

3. Any point teachers added at the follow-up interview

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